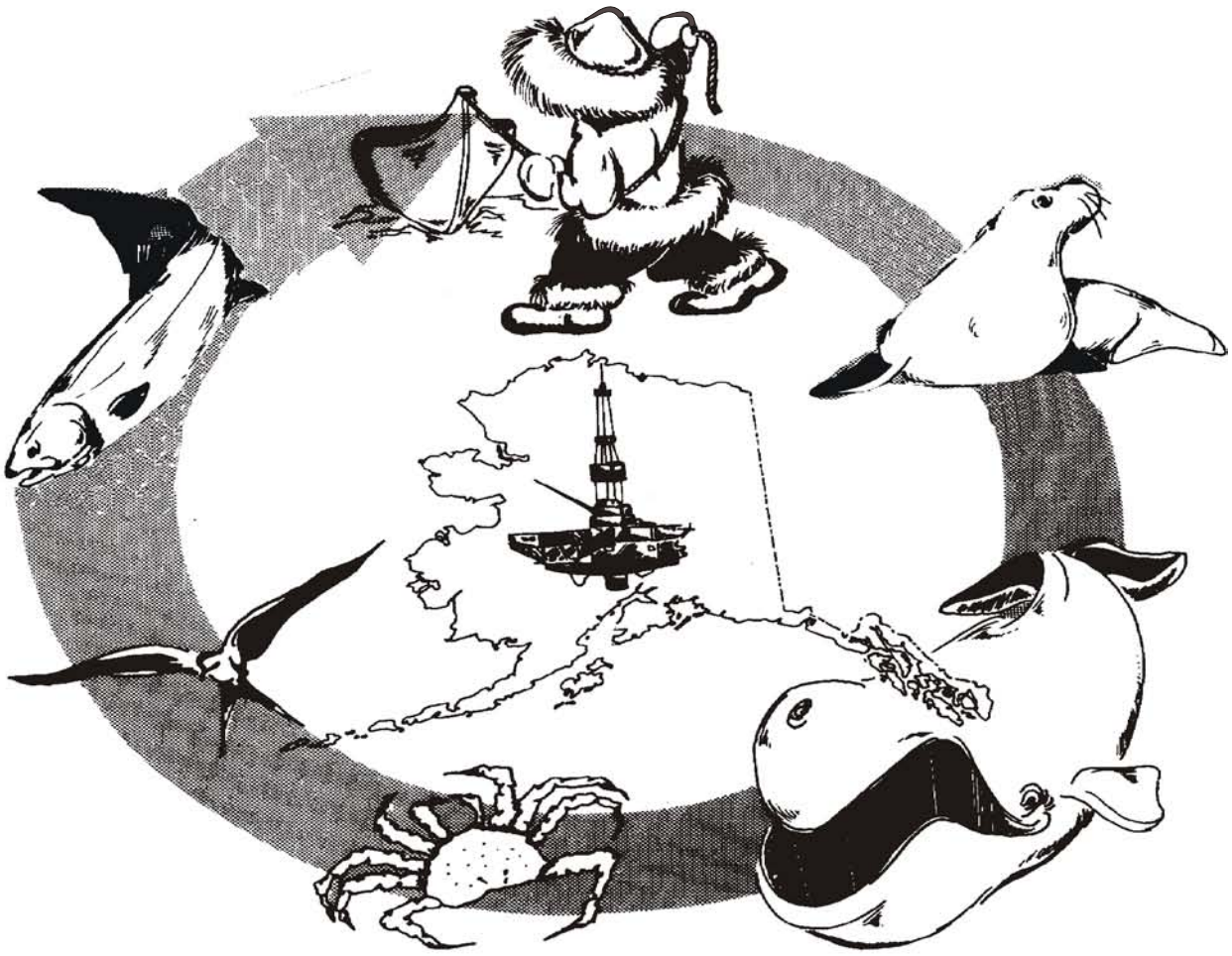
Alaska Outer Continental Shelf Region

Alaska Annual Studies Plan Final FY 2006



U.S. Department of the Interior
Minerals Management Service
Alaska Outer Continental Shelf Region
Anchorage, AK

September 2005

Prepared by
U.S. Department of the Interior
Minerals Management Service
Alaska Outer Continental Shelf Region
3801 Centerpoint Drive, Room 500
Anchorage, Alaska 99503-5823

September 2005

For copies of this document, please contact Tim Holder at (907) 334-5279 or by email, Tim.Holder@mms.gov or access at http://www.mms.gov/alaska (click on Environmental Studies Section).

The inclusion of studies proposed in this document does not constitute a commitment by the U.S. Department of the Interior, Minerals Management Service, to conduct or fund any or all of the studies. The scope of the studies is subject to change prior to initiation of any work.

Any use of trade names is for description purposes only and does not constitute endorsement of these products by the Minerals Management Service.

United States Department of the Interior

MINERALS MANAGEMENT SERVICE
Alaska Outer Continental Shelf Region
3801 Centerpoint Drive, Suite 500
Anchorage, Alaska 99503-5823

Dear Stakeholder:

We are interested in knowing any comments or suggestions you may have for the *MMS Alaska Annual Studies Plan Fiscal Year (FY) 2007*, which we are now formulating. For your reference, we are enclosing the Final *Alaska Annual Studies Plan (ASP) FY 2006.*

To assist us in processing any suggestions for additional studies, please use the format for a Study Profile as shown in Enclosure 1. Please keep in mind that studies proposed for our consideration must address specific MMS mission and decision needs. Comments or suggestions need to be received by on us on or before October 30, 2005 to assure FY 2006 consideration. Following revisions to the plan, we will issue a Final FY 2007 Alaska ASP.

Thank you for your participation in this review and we look forward to your response. If you have any questions, please contact Mr. Tim Holder, ASP Coordinator, at 907-334-5279.

Sincerely,

Cleve Cowles, Ph.D.
Chief, Environmental Studies Section

Enclosures

TAKE PRIDE IN AMERICA

Minerals Management Service Alaska Environmental Studies Program

Proposed Study for FY 2007

We recommend studies profile be less than 2 pages to meet MMS requirements. Please do not try to make this a detailed scope of work. If the study is selected for funding, MMS will prepare a more detailed scope of work.

Region: Alaska *[Standard for all.]*

Planning Area(s): *[e.g., Beaufort Sea, Chukchi Sea, Cook Inlet, as applicable. See Fig.1 of the Plan.]*

Title: *[Fill in concise title.]*

MMS Information Need(s) to be Addressed: *Provide a brief and conclusive reason(s) why MMS needs the information. Explain how this information will be used to manage OCS resources. Identify how the study relates to analysis under the National Environmental Policy Act and/or specific MMS decision(s), such as formulation of a mitigation measure. Please be as specific as possible.*

Period of Performance: FY 2007-*200X*

Description:

Background Please provide 1 to 2 paragraphs on relevant issues, what information is required and pertinent background. Include details about whether this study ties in with other efforts, and if so, how. Include a description of the current status of information. That is, what is the level of adequacy of existing information, does any exist, does it need to be more geographically specific?

Objectives Clearly and succinctly state the objective(s) of the study. Explain what questions will be answered by this study. We encourage the use of lists (1, 2, 3, etc.) for multiple, related objectives.

Methods Provide brief detail on what information, techniques or methods are available that could be used. Explain how the objectives of the study will be accomplished. We encourage the use of lists (1, 2, 3, etc.).

Date information is required: *Provide dates when products would be most useful, such as "Final report is needed by December 2008." If the product of the study is something other than the scientific report (e.g. database, model, bibliography), explain it in this section.*

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Section 2.1: Study Profiles for Ongoing Studies (Continued)

Protected Species

Section 2.1: Study Profiles for Ongoing Studies (Continued)

Social Science and Economics

Multidisciplinary

Other

ACRONYMS, INITIALISMS, ABBREVIATIONS, AND SYMBOLS

ABL	Auke Bay Laboratory
ACS	Alaska Clean Seas
ADCP	acoustic Doppler current profiler
ADF&G	Alaska Department of Fish and Game
AEPS	Arctic Environmental Protection Strategy
AEWC	Alaska Eskimo Whaling Commission
AFTC	Alaska Frozen-Tissue Collection
AK	Alaska
AMAP	Arctic Monitoring and Assessment Program
AMMTAP	Alaska Marine Mammal Tissue Archival Project
ANCSA	Alaska Native Claims Settlement Act
ANIMIDA	Arctic Nearshore Impact Monitoring in Development Area
ANWR	Arctic National Wildlife Refuge
ASP	Annual Studies Plan (Alaska OCS Region)
baci	before/after, control/independent [evaluation]
Bbl	barrel
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BRD	Biological Resources Division (USGS)
C	Celsius
CAFF	Conservation of Arctic Flora and Fauna [working group]
cANIMIDA	Continuation of Arctic Nearshore Impact Monitoring in Development Area
CD-ROM	Compact Disk Read Only Memory
C.F.R.	Code of Federal Regulations
CI	Confidence Interval
CIRCAC	Cook Inlet Regional Citizens'Advisory Council
cm	centimeter
CMI	Coastal Marine Institute
CODAR	Coastal Ocean Dynamics Application Radar
COMIDA	Chukchi Offshore Monitoring in Drilling Area
CORIS	Coastal Offshore Resource Information System
COZOIL	Coastal and Surf Zone Oil-Spill-Transport Model
CP	Comprehensive Program
CRREL	Cold Regions Research Engineering Laboratory (US Army Corps of Engineers)
CTD	conductivity-temperature-depth [measuring device]
DEW	Defense Early Warning
DOI	Department of Interior
DPP	Development and Production Plan
EA	Environmental Assessment
EAS	Environmental Assessment Section
ECMRWF	European Center for Medium Range Weather Forecasting
Ed.	Editor
Eds.	Editors
e.g.	for example
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ESP	Environmental Studies Program
EVOS	*Exxon Valdez* Oil Spill
FEAM	Fisheries Economic Assessment Model
Fig.	Figure

FJMC	Fisheries Joint Management Committee
FLIR	Forward Looking Infra-Red (FLIR) Imagery
FNOC	Fleet Numerical Oceanography Center
FY	Fiscal Year
GIS	Geographical Information Systems
GPS	Global Positioning System
GSA	General Services Administration
GUI	Graphical User Interface
Hg	Mercury
IA	Interagency Agreement
IBR	Information Base Review
i.e.	that is
IMPLAN	Impact Analysis for Planning
IOOS	Integrated Ocean Observing System
IPY	International Polar Year
IR	infrared
ITM	Information Transfer Meeting
IUM	Information Update Meeting
kHz	kiloHertz
km	kilometer
m	meter
ml	milliliter
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service
MODIS	Moderate Resolution Imaging Spectroradiometer
NAB	Northwest Arctic Borough
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NODC	National Oceanographic Data Center
NOPP	National Oceanic Partnership Program
NORM	normally occurring radioactive materials
NPDES	National Pollutant Discharge Elimination System
NPR-A	National Petroleum Reserve-Alaska
NRC	National Research Council
NSB	North Slope Borough
NSF	National Science Foundation
NSP	National Strategic Plan (MMS)
NTIS	National Technical Information Service
OCS	Outer Continental Shelf
OCSEAP	Outer Continental Shelf Environmental Assessment Program
OCSLAA	Outer Continental Shelf Lands Act as Amended
OCSLA	Outer Continental Shelf Lands Act
OSCR	Ocean Surface Current Radar
ODPCP	Oil Discharge Prevention and Contingency Plan
ODPCP	Oil Discharge Prevention and Contingency Plan
OMPA	Office of Marine Pollution Assessment
OPTP	Oil Prevention and Technical Plan
OSRA	Oil-Spill Risk Analysis
OWM	Oil-Weathering Model

PAH	polycyclic aromatic hydrocarbons
PC	personal computer
PDF	portable document file
ppm	parts per million
RFIC	Request for Information and Comments
ROMS	Regional Ocean Model System
SAR	Synthetic Aperture Radar
Sea WIFS	Sea-viewing Wide Field-of-View Sensor
SDE	Spatial database engine
SIOMS	Sea Ice-Ocean-Oil Spill Modeling System
SNOMED	Systematized Nomenclature of Medicine
SPED	Sub-sea Physical Environmental Database
SPEM	Semi-Spectral Primitive Equation Model
SPSS	Scientific Package for the Social Sciences
SRB	Scientific Review Board
TAG	Technical Assessment Group
TAR	Technology Assessment and Research [Program]
TBD	To Be Determined
TDR	Time-depth recorder
TIMS	Technical Information Management System
UAA	University of Alaska Anchorage
UAF	University of Alaska Fairbanks
U.S.	United States
USDOC	U.S. Department of Commerce
USDOD	U.S. Department of Defense
USDOI	U.S. Department of the Interior
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
U.S.S.R.	Union of Soviet Socialist Republics
VHF	very high frequency
WOSM	World Oil-Spill Model

Symbols

>	greater than
<	less than

SECTION 1.0 PROGRAMATIC OVERVIEW

1.1 Introduction to the Region

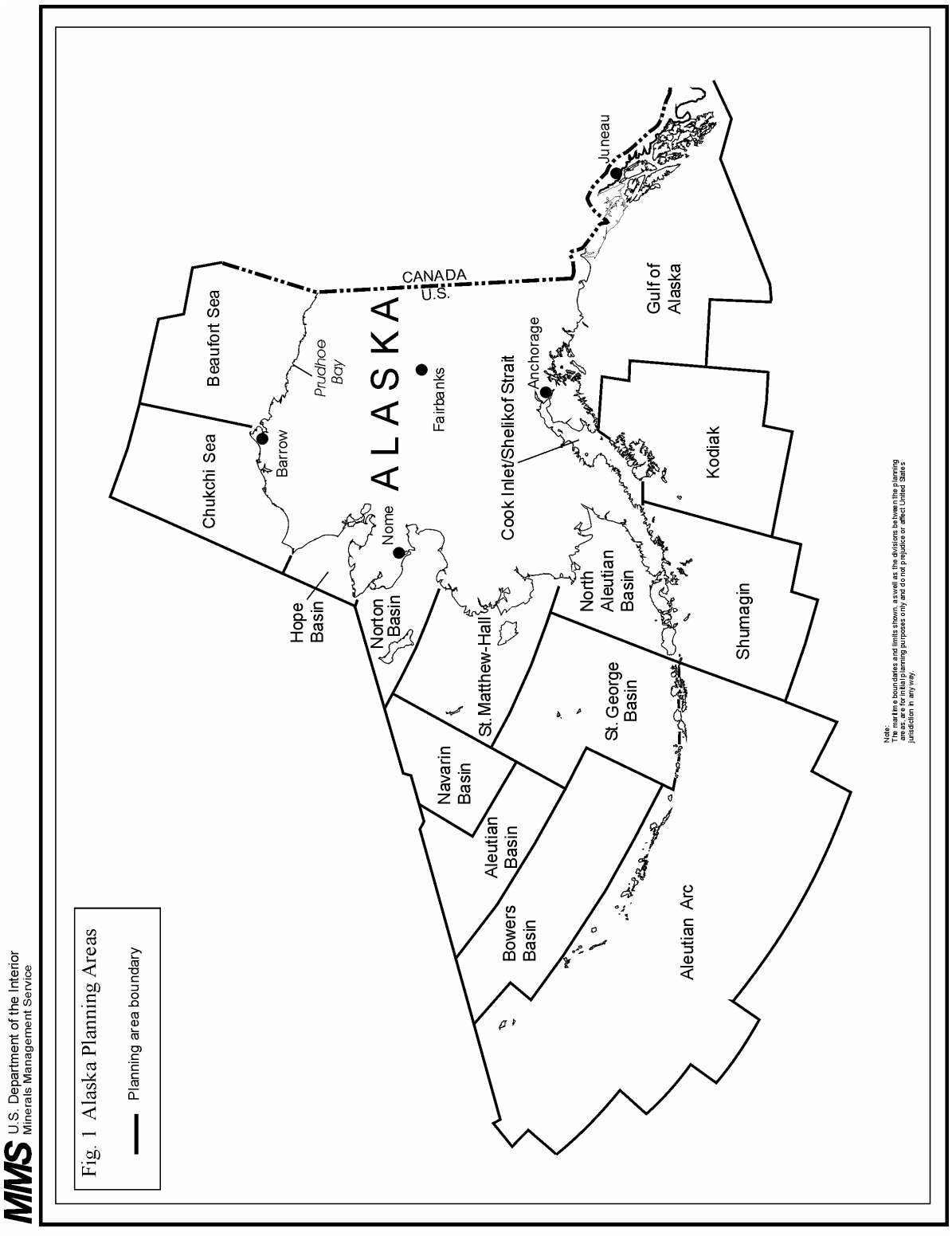
1.1.1 Background

The Alaska Environmental Studies Program (ESP) was initiated by the U.S. Department of the Interior (USDOI) in 1974 in response to the Federal Government's decision to propose areas of Alaska for offshore oil and gas development. Federal management of the Outer Continental Shelf (OCS) is guided by several legislative acts. Regulations implementing the OCS Lands Act (OCSLA) of 1953, as amended in 1978 (OCSLAA), designated the Bureau of Land Management (BLM) as the administrative agency responsible for leasing and the U.S. Geological Survey (USGS) as responsible for supervising classification, evaluation, development, and production of mineral resources on submerged Federal lands. The offices under BLM and USGS responsible for offshore leasing were reorganized as the Minerals Management Service (MMS) in 1982. One of the goals of the OCSLA was to provide for protection of the environment concomitant with mineral-resource development. The OCSLA requires the Secretary of the Interior to conduct environmental studies to obtain information pertinent to sound leasing decisions as well as to monitor the human, marine, and coastal environments (OCSLAA, 1978 [Public Law 95-372, Section 20]). Also, the National Environmental Policy Act (NEPA) of 1969 requires that all Federal Agencies use a systematic, interdisciplinary approach that will ensure the integrated use of the natural and social sciences in any planning and decision making that may have effects on the environment. Federal laws impose additional requirements on the offshore leasing process, including the Coastal Zone Management Act; Federal Water Pollution Control Act Amendments; Marine Mammal Protection Act (MMPA); Endangered Species Act (ESA); and Marine Protection, Research, and Sanctuaries Act.

The purpose of the ESP is to define information needs and implement studies to assist in predicting, projecting, assessing, and managing potential effects on the human, marine, and coastal environments of the OCS that may be affected by oil and gas development. Lease-management decisions are enhanced when current, pertinent, and timely information is available. To attain program goals, scientific results on specific environmental, social, and economic questions arising from offshore leasing are required. The ESP then monitors any effects during and after oil exploration and development. It is the largest, single-agency, mission-oriented, marine-studies program in the Federal Government. Since the ESP inception through Fiscal Year (FY) 2004, more than $768 million have been spent on the ESP nationally. More than $285 million of this amount has funded Alaskan studies in 15 planning areas in the Arctic, Bering Sea, and Gulf of Alaska Subregions (see Fig. 1).

Early in the development of the program, the focus was on obtaining baseline information on the vast biological resources and physical characteristics of the Alaskan environment for prelease decision making. These studies included biological surveys of marine species, basic oceanography and meteorology, and geologic and sea-ice phenomena. As

Figure 1. Alaska Planning Areas



a broader base of information was established, it became possible to focus on more topical studies in smaller areas to answer specific questions and fill identified information needs. In addition, a number of generic studies were initiated on the potential effects of oil spills on biological resources and on the probable transport and dispersion of oil that might be spilled in the marine environment.

The use of computer-modeling techniques has been implemented to aid in the assessment of potential oil spill and other pollutant risks to the environment and to key species such as fur seals, sea otters, and endangered whales. Modeling also has been used in the ecosystem studies, especially where extrapolation to other areas seemed warranted.

As more disciplinary data were collected and analyzed, the importance of taking an integrated, interdisciplinary look at complete ecosystems in sensitive areas became apparent. During this time, the offshore leasing program was maturing. As a number of sales were held and exploration activities began, postlease studies to monitor the possible effects of oil and gas activities on the environment and resources of these areas were initiated. The ESP provides information for development of the 5-year leasing schedule and for prelease- and lease-related decisions, and develops monitoring information necessary for postlease management.

As studies information has been amassed, improved focus has required greater integration of various scientific disciplines. The MMS has initiated Synthesis Meetings, Information Transfer Meetings (ITM's), and Information Update Meetings (IUM's) to gather maximum expertise and assess the status of existing information, and to plan the best possible approach to a study within the constraints of time and resources. As the MMS and other Federal and State agencies collect more pertinent information, the MMS funds studies to search and evaluate existing literature and data prior to initiation of field efforts. This prevents duplication of effort and saves valuable resources by focusing later study efforts on the areas of greatest information need and highest usefulness to MMS decision needs.

As noted by the National Research Council (NRC, 1994), the MMS Alaska ESP is "extensive, substantive and high quality." However, the Alaska ESP has been challenged to meet its mission in an increasingly conservative fiscal environment. Despite this challenging situation, the ESP, at the national level and in all the regions including Alaska, remains committed to attaining quality environmental information.

The *Final Alaska Annual Studies Plan FY 2006 (*prepared in September 2005) complements and reinforces the *Environmental Studies Program National Strategic Plan (NSP) 1998-2002*. The NSP has several broad themes, which include the following:

- Monitoring Marine Environments
- Seismic and Acoustic Impacts
- Understanding Social and Economic Impacts
- Oil-Spill Research Techniques
- Efficient and Effective Information Management

To be responsive to leasing plans, related issues, and offshore technologies, the Alaska OCS Region proposes new studies and innovates in conjunction with the NSP themes. Due to the great differences existing between Alaskan environments and other OCS areas, the uniqueness of the environment and related issues in Alaska underscores the need to be flexible in planning and implementation of needed studies.

1.1.2 Issues To Be Addressed

At each step of the offshore leasing and development process, a variety of potential issues or resource-use conflicts may be encountered. This section "Issues To Be Addressed" forms a framework for the section titled "Identification of Information Needs." As a result of issues characterized by uncertain information we identify specific Information Needs. Two questions are fundamental:

- What is the expected change in the human, marine, and coastal environment due to offshore development and, therefore, expected change in benefits to humans from affected natural resources?

- Can undesirable change be minimized by mitigating measures?

Environmental studies are very important to answering both types of questions; and are expected to provide information useful to decision making in both regards. Currently the Alaska ESP has primary focus on upcoming developments, possible lease sales, and existing leases in the Beaufort Sea, Cook Inlet, and Chukchi Planning Areas.

Current offshore oil- and gas-related issues for which studies are proposed in the Beaufort Sea, Chukchi/Hope Basin, and Norton Basin Planning Area include, but are not limited to:

- What long-term changes in heavy metal and hydrocarbon levels may occur near Beaufort Sea development prospects such as Liberty or regionally along the Beaufort Sea coast?

- What role will currents play in distribution of anthropogenic pollutants near development prospects?

- What long-term changes in underwater industrial noise will occur and how might such noise propagate near development prospects relative to ambient noise levels?

- What changes might occur in habitat, distribution, abundance, and movement of key, potentially sensitive species such as bowhead whales, waterfowl, polar bears, other marine mammals, or fish?

- What interactions between human activities and the physical environment have affected potentially sensitive species?

- What is the extent of bowhead whale feeding in future proposed or potential lease sale areas?

- What changes might occur in socioeconomics and subsistence lifestyles of coastal Alaska communities?

- What are current subsistence harvest patterns and what changes might occur in key social indicators as a result of offshore exploration and development?

- What changes might occur in sensitive benthic communities such as the Stefansson Sound "Boulder Patch," other Beaufort Sea kelp communities or fish habitats?

- What refinements are there to our knowledge of major oceanographic and meteorological processes and how do they influence the human, marine, and coastal environment?

- How do we improve our projection of the fate of potential oil spills?

- If oil is spilled in broken ice, what will its fate be?

- What effects might pipeline construction have on nearby marine communities or organisms?

- How can we better integrate local and/or traditional knowledge into conducting studies related to the Alaska ESP?

Similarly, there are a number of offshore oil- and gas-related issues that environmental studies in the Cook Inlet Region propose to address, including but not limited to:

- What long-term change in anthropogenic hydrocarbon compounds has occurred in water and sediment?

- What refinements are there to our knowledge of major oceanographic and meteorological processes in Cook Inlet and Shelikof Strait and how do they influence the human, marine, and coastal environment?

- How do we improve our prediction of the fate of potential oil spills?

- What long term changes related to past or future activities have occurred in marine food webs, especially regarding key fish, seabirds and sensitive marine mammals?

- What are the effects of offshore oil and gas exploration and development on important socioeconomic activities such as commercial fishing or existing community infrastructures?

- What are the near-term and long-term effects on key economic activities such as sport fisheries?

- What are current subsistence harvest patterns and what changes might occur in key social indicators as a result of offshore exploration and development?

- How can we better integrate local or traditional knowledge into conducting studies related to the Alaska ESP?

1.1.3 Planning Involvement

As proposals for exploration and development continue to evolve, Alaska's coastal communities on the Beaufort Sea are expecting increased involvement in project reviews and decisions that may affect their subsistence lifestyle. Since the people of Alaska's remote Arctic communities rely so heavily on subsistence resources of the marine environment, they are especially concerned about industrial activities that may directly or indirectly affect hunting success or the habitats of the species important to subsistence.

Over the years, the MMS ESP continues to involve Alaskans and others in its research planning and execution in a number of ways. Solicitation of comments on the Alaska Annual Studies Plans (ASP's) has been practiced for years. The MMS ESP has sought out and included the knowledge of coastal community residents in planning. Another key source of input is discussion and advice on the ASP by the OCS Scientific Committee, which occurs on an annual basis. Other public involvement, such as that on study project-management-review boards has assisted the MMS. In all MMS field-oriented studies, researchers coordinate directly with local communities to discuss their plans, seek advice, and assure that interested individuals learn about the project and its results. Recently, the MMS has incorporated local and traditional knowledge of Alaskan residents directly in the preparation of its EIS's and decision documents.

The MMS sponsored a Social and Economic Planning Conference in 1999. For the Alaska Region, discussions of major issues focused on impact assessment, monitoring key indicators, local and traditional knowledge, and stakeholder involvement. The Alaska Region has taken the results of this Conference into consideration in preparing study profiles for proposed studies and scopes of work for studies to be contracted. Further information on this conference is available at http://www.mms.gov/eppd/socecon/conference.htm.

There is a continuing process to synthesize information from many projects into a broader, multi-disciplinary view of research results. Of particular importance is the sharing of information among scientific fields. Past efforts such as MMS ITM's also have helped us guide the design of future studies toward a more encompassing involvement of local and traditional information with scientific activities. Local and traditional knowledge has been incorporated into specific study planning, fieldwork, and interpretation of results over the years of the ESP. The process of melding local and

traditional knowledge varies from project to project, but the outcome of better information for decision making is a common goal.

1.1.4 Coordination and Cooperation

The Alaska ESP through its day-to-day operations and ASP process:

- Coordinates plans and ongoing studies with other ongoing programs and research projects to assure optimal studies management and to manage budget resources efficiently.
- Enhances utilization of existing information.
- Shares logistics and equipment.
- Enhances team approaches to interdisciplinary projects.

Currently a major portion of the Alaska ESP is conducted on a cooperative basis. In 1993, to take advantage of scientific expertise at the local level in addressing issues of mutual concern, the MMS developed the Coastal Marine Institute (CMI). Under an initial 5-year Cooperative Agreement with CMI, the MMS committed $1,000,000 per year with a dollar-for-dollar match arrangement of Federal and State funds. The University of Alaska Fairbanks (UAF) School of Fisheries and Ocean Sciences, nationally recognized for its coastal and marine expertise, administers the Alaskan CMI. The cooperative agreement was renewed for another 5 years in 2002. In addition to funding CMI scientific research, a substantial portion of the MMS contribution supports education in Alaska by funding tuition and travel for UAF graduate-student research related to CMI projects.

The Alaska ESP also coordinates with other U.S. and local research entities such as the National Science Foundation, Arctic Research Commission, USGS- Biological Resources Division, *Exxon Valdez* Oil Spill Trustee Council research program, North Pacific Research Board, North Slope Borough Department of Wildlife Management, National Research Council, Polar Research Board, Cook Inlet Regional Citizens Advisory Council, industry programs, and others. Additional international linkages with other arctic nation's research and regulatory entities have been established.

Recently, the U.S. and seven other arctic nations voluntarily agreed to cooperate on an Arctic Environmental Protection Strategy (AEPS) which has evolved into the formation of the Arctic Council in 1996. The Alaska ESP maintains contacts and coordination with Arctic Council activities, such as the Arctic Monitoring and Assessment Program (AMAP), Conservation of Arctic Flora and Fauna (CAFF), Arctic Climate Impact Assessment (ACIA), and others. The ESP provides information to these working groups through review of reports and plans, and helps to inform participants of available information sponsored by MMS. Further, specific studies that can coordinate and integrate with working group activities are identified and beneficial linkages facilitated.

The polar regions play key roles in our global environment. Many important broad and interlinked research challenges involving both polar regions exist today. At its most

fundamental level, the International Polar Year (IPY) 2007-2008 is a coordinated campaign of polar observations, research, and analysis that will be multi-disciplinary in scope and international in involvement. The IPY, see http://www.ipy.org , will use today's research tools to better understand the key roles of the polar regions in global processes. MMS has several proposed studies which are expected to dovetail with the IPY activities.

1.2 Projected OCS Activities

1.2.1 Prelease Considerations

This *Final Alaska Annual Studies Plan FY 2006* (prepared September 2005) reflects consideration of the proposed lease sales in the *Final Outer Continental Shelf Oil and Gas Leasing Program 2002-2007* (July 2002). In a frontier region such as the Alaskan Arctic with large and remote planning areas, potential environmental hazards associated with offshore activities, and still-evolving technology required for hydrocarbon extraction, maximum lead-time is necessary to conduct adequate environmental studies.

The *Final Outer Continental Shelf Oil and Gas Leasing Program 2002-2007* proposes Lease Sales in the Beaufort Sea in 2007; in Cook Inlet/Shelikof Strait in 2006; Chukchi/Hope Basin; and possibly in Norton Basin (see Fig.1). Companies did not express interest in Cook Inlet Lease Sale 199, so MMS has postponed Sale 199 from 2006 to 2007. MMS will evaluate in 2006 whether to restart planning for Sale 199 in 2007. MMS will not proceed with the Lease Sale process for Hope Basin or Norton Basin due to a lack of industry interest. Industry expressed interest in the Chukchi OCS in 2005. Studies proposed for FY 2006 are for EIS's, related NEPA analysis for these possible lease sales, and postlease NEPA analysis.

Preparation of the EIS is an essential and the most important part of the prelease process that requires environmental information. In particular, information is needed in time to prepare draft EIS's for proposed lease sales. Although much information exists for certain Alaska OCS lease areas, changing conditions and environments often lead to the need to update past studies so that EIS information is current and accurate.

1.2.2 Postlease Considerations

Prior to FY 1982, most studies of the Alaskan offshore were planned, conducted, and concluded before a sale was held to provide decision information for EIS's. However, not all information needs can be obtained prior to a sale. In accordance with mandates of Section 20 of the OCS Lands Act, as amended, postlease studies are needed to address environmental concerns and monitoring related to specific developments. The MMS acquires additional information for environmental analyses related to development and production in the postlease phase environmental analyses. Thus, an increasing number of studies have become more closely related to development schedules and monitoring and

evaluation in addition to those broader studies related to the prelease phase. As with the prelease phase, the wide range of environmental conditions from Cook Inlet to the Arctic and planning lead times are accounted for in the process of formulating new studies for the ASP.

Postlease activities that raise issues and require environmental data and assessment are:

- Geophysical surveys.
- Exploration drilling.
- Development, construction, and production activity.
- Oil transportation, including pipelines and tankers.
- Lease termination or expiration (platform abandonment).

In the Beaufort Planning Area, there have been 839 tracts leased in nine OCS Lease Sales. Industry has drilled thirty-one exploratory wells and determined 11 to be producible. As of August 2005, there are 181 active leases (see Fig. 2) on the Beaufort Federal offshore. Lease Sale 195 in March 2005 accounts for 117 of the 181 active Beaufort leases.

Of these, the British Petroleum Exploration Alaska (BPXA) Northstar development project is located about 10 miles north of Prudhoe Bay (see Fig. 2 and Fig. 3). While the Northstar Island is in State waters, 6 to 7 wells will be on the OCS. The project was approved by the U.S. Army Corps of Engineers May 1999 and by MMS September 1999. Construction started in the winter of 2000. Production started the last day of October 2001. Recoverable reserves are estimated at 158 million barrels of oil, with peak daily production estimated at 65,000 barrels per day.

A BPXA proposed project is the Liberty Unit in Foggy Island Bay (see Fig. 2). It is located about 6 miles east of the State Endicott Project. MMS released the *Draft Environmental Impact Statement for the Liberty Development and Production Plan* (January 2001). In January 2002 BPXA put the Liberty project on hold. MMS issued the Final EIS for the project in May 2002. Recoverable reserves are estimated at 120 million barrels of oil. As of September 2005 BPXA is pursuing options for development and production from Liberty.

AEC Oil & Gas (USA) Inc. filed a plan for exploration on McCovey in the fall of 2002 (see Fig. 2). MMS approved the plan in February 2002. The firm plugged and abandoned it in February 2003.

The only other active leases are in the Cook Inlet Planning Area. Cook Inlet Lease Sale 149 was held in June 1997 and generated two leases (see Fig. 4). The Cook Inlet Lease Sale 191, announced May 2004, did not receive any bids.

There are no active leases from previous lease sales in the Chukchi Sea or Hope Basin portions of the Arctic Subregion, or in the Bering Sea or Gulf of Alaska Subregions (see Fig. 1).

1.3 Identification of Information Needs

We distributed the *Final Alaska Annual Studies Plan FY 2005* (September 2004) to approximately 200 Federal, State, local, environmental, Native, industry, international, and other stakeholders in September 2004. We also distributed a letter to the same stakeholders requesting suggestions for new studies for the FY 2006 in September 2004. We considered comments in response to that request and previous program reviews. In addition, we requested suggestions for new studies from all components of the Alaska OCS Region staff and considered their comments.

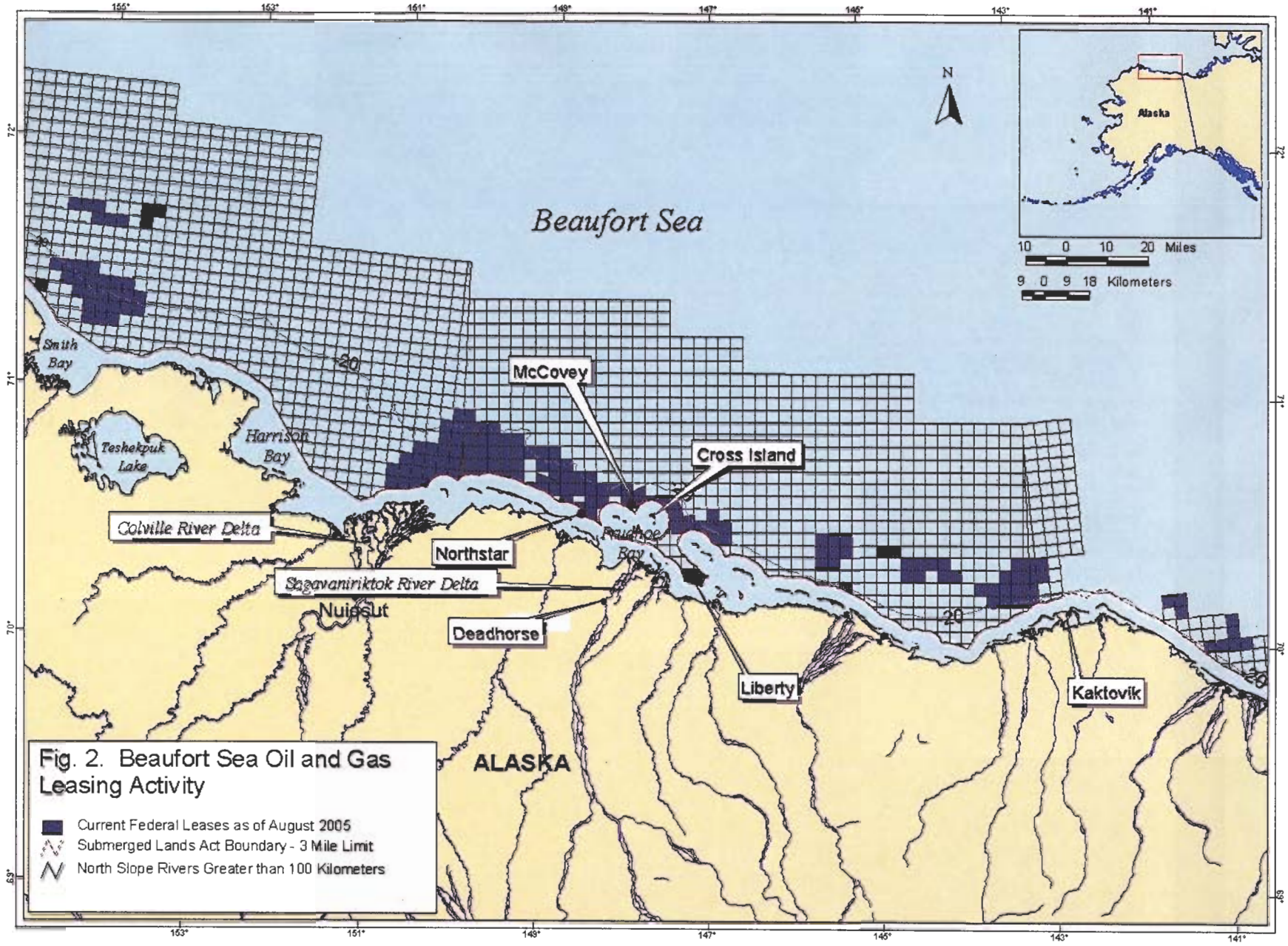
The ESP also relies heavily on information needs identified through solicitation of public comment and suggestions on how to enhance our information base at Information Transfer Meetings (ITM) and other meetings. For example an ITM was held in March 2005 and one is scheduled for March 2007. Invitations for the 2005 ITM were sent throughout Alaska to State and Federal Agencies; borough, city, tribal, and village leaders; oil and fishing industry personnel; environmental groups; scientists; contractors; and others. Approximately 100 people, including about 30 MMS personnel, attended various sessions. Also, in March 2005, a third Beaufort Sea Information Update Meeting (IUM) was held in Barrow, with 11 presentations. At both the ITM and the IUM, MMS provided updates on the status of the Alaska environmental study plans. At each of these meetings session chairs encouraged attendees to comment on the information available, either through oral involvement in the question-and-answer periods or afterward.

MMS sponsored a 2.5 day workshop on physical oceanography in the Beaufort Sea in February 2003 in Fairbanks, Alaska. The workshop started with presentations by 15 experts on various aspects of physical oceanography. Another 20 individuals participated. After discussion of the topic areas, the group recommended physical oceanography studies to support the MMS mission with respect to industrial development on this shelf or along the coast.

MMS sponsored a 3 day workshop on Arctic cisco in the Beaufort Sea in November 2003 in Nuiqsut, Alaska. The workshop involved local residents (including Village elders) and scientists. After discussion of topic areas, the group generated a ranked list of questions and issues about Arctic cisco to help identify possible studies.

MMS sponsored a 1.5 day research sponsorship meeting on mapping of surface currents from high frequency radar in Cook Inlet and the Beaufort Sea in March and April 2004 in Anchorage, Alaska. After discussion of the topic areas, the meetings recommended that MMS study the central Beaufort Sea OCS and the lower Cook Inlet OCS to measure surface currents from high frequency radar. More information on this workshop can be found in its report (MMS OCS Study 2004-045).

Several of the approved and proposed studies address recommendations from Cook Inlet communities and the Cook Inlet Regional Citizens Advisory Council (CIRCAC); and a few of the proposed studies also were highlighted in previous ESP plans.


Beaufort Sea
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Alaska
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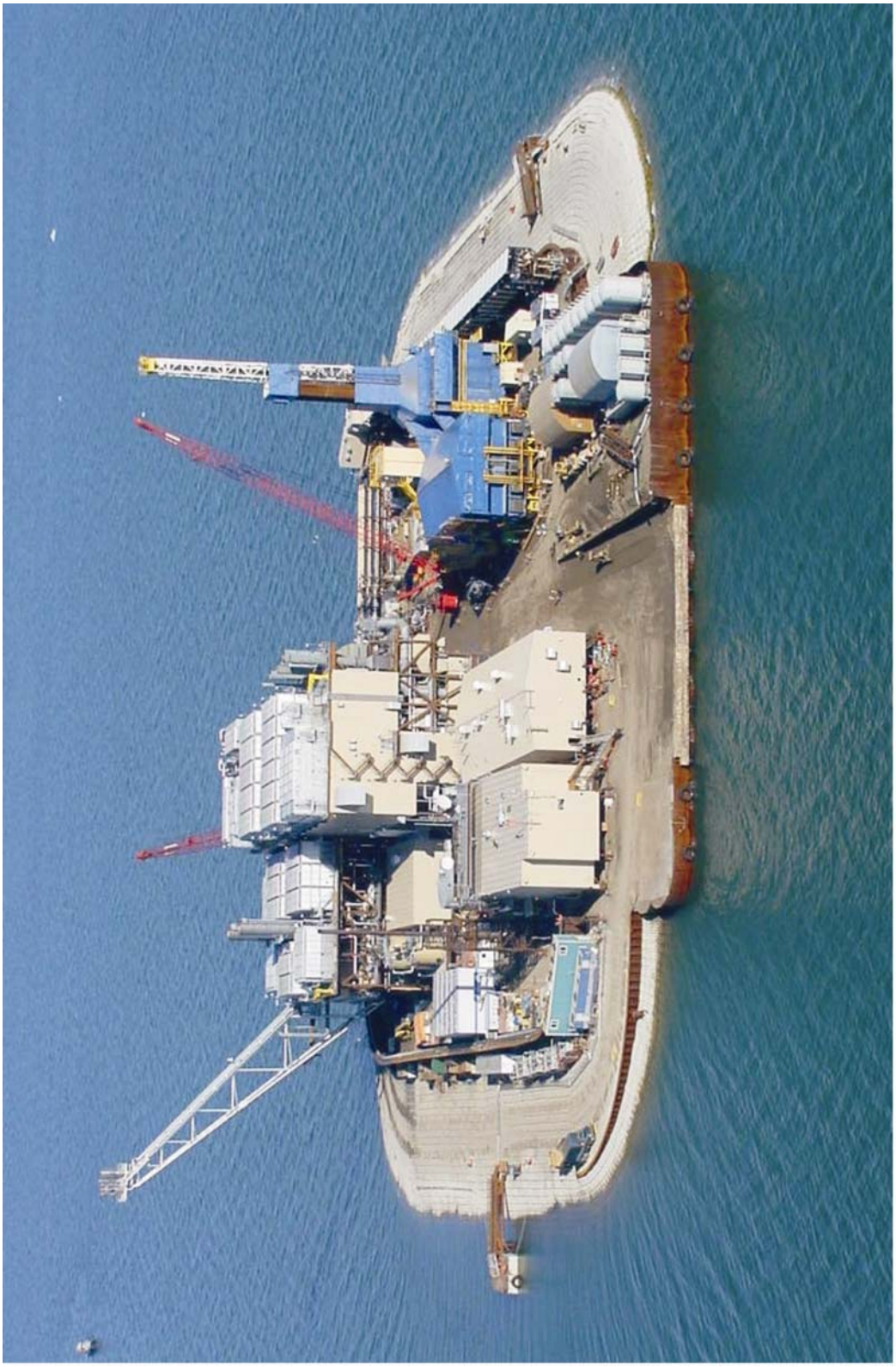
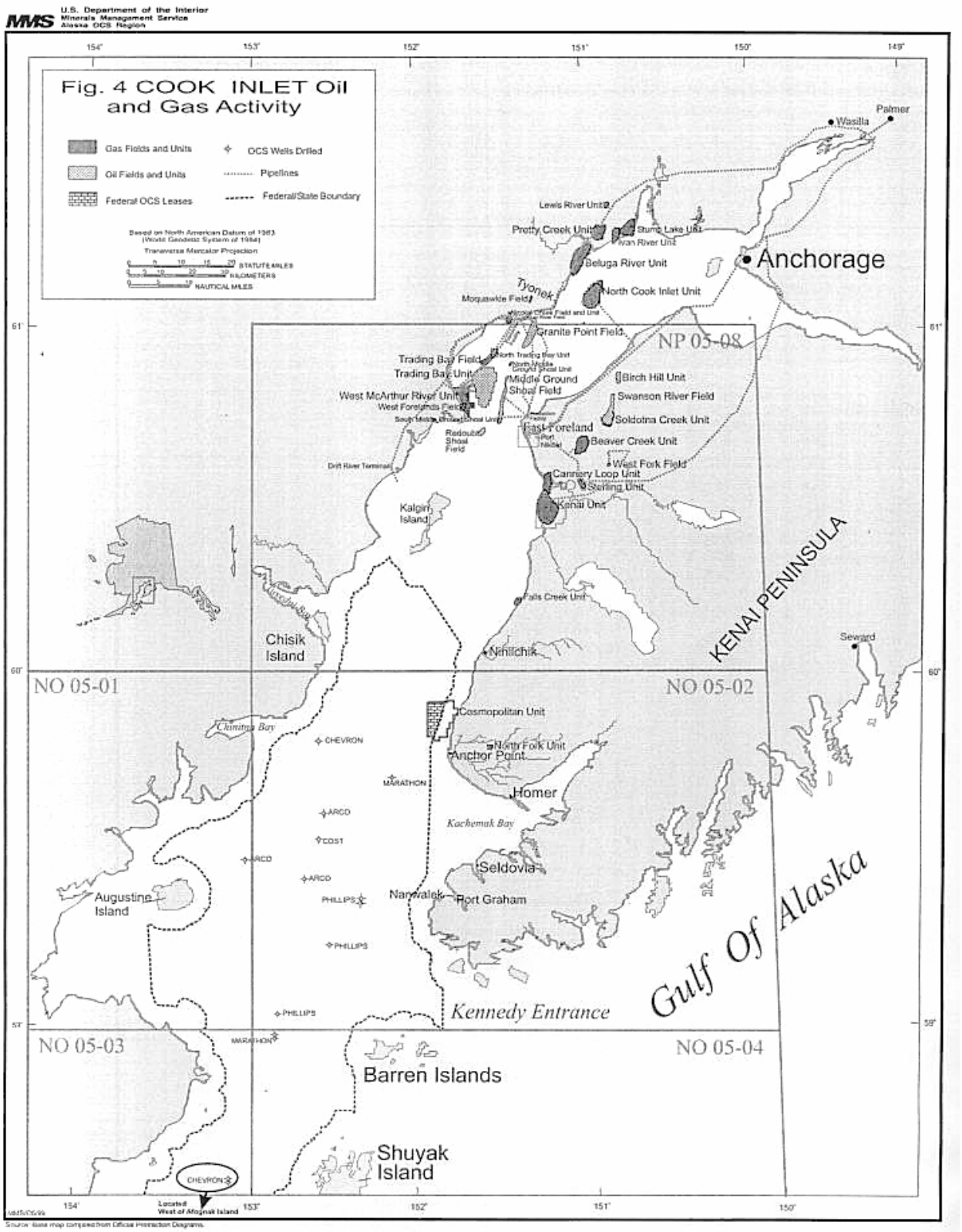
9 0 9 18 Kilometers
Smith Bay
Harrison Bay
Teshekpuk Lake
Colville River Delta
Sagavanirktok River Delta
Nuiqsut
Prudhoe Bay
McCovey
Cross Island
Northstar
Deadhorse
Liberty
Kaktovik
20
ALASKA
Fig. 2. Beaufort Sea Oil and Gas Leasing Activity
Current Federal Leases as of August 2005
Submerged Lands Act Boundary - 3 Mile Limit
North Slope Rivers Greater than 100 Kilometers

Figure 3. Northstar Island August 2000



Northstar Island looking north, September 2001. Production started in November 2001.

Figure 4. Cook Inlet Oil- and Gas-Leasing Activity



Studies also address recommendations from the National Research Council (NRC) on the Alaska ESP. A review entitled *Environmental Information for Outer Continental Shelf Oil and Gas Decisions in Alaska* (NRC, 1994) was conducted in response to a request from the U.S. House of Representatives that MMS seek NRC advice about the adequacy of environmental information for Beaufort Sea lease sales. The NRC committee concluded that the environmental information currently available for the Beaufort Sea OCS area is generally adequate for leasing and exploration decisions, except with regard to effects on the human environment (NRC, 1994: Executive Summary, p. 3). Since that time, the MMS has enhanced research components on the human environment. The Alaska ESP has also considered a series of reviews of the national ESP by the NRC. The reviews are titled "Assessment of the U.S. Outer Continental Shelf Environmental Studies Program." Volume I focuses on Physical Oceanography (NRC, 1990), Volume II on Ecology (NRC, 1992a), and Volume III on Social and Economic Sciences (NRC, 1992b); Volume IV summarizes Lessons and Opportunities (NRC, 1993).

MMS will work with affected Federal, State, local agencies, and tribes in a variety of ways to continue to address the many useful recommendations from the NRC in *Cumulative Environmental Effects of Oil and Gas Activities on Alaska's North Slope* (NRC 2003). MMS is in the process of considering and addressing the recommendations relevant to the OCS programs.

1.3.1 Beaufort Sea General Information Needs

Long-Range Monitoring of Interdependent Physical, Biological, and Social Processes:

Both offshore and onshore oil and gas development and production activities are increasing across Alaska's North Slope. Residents of Nuiqsut, Kaktovik and Barrow are particularly concerned about long-term effects of offshore developments at Northstar and other possible developments as well as long-term and cumulative effects of any exploration from OCS Beaufort Sea lease sales. Interagency reviews of related EIS's and Development and Production Plans are expected to lead to additional recommendations for monitoring impacts of Northstar and other possible developments. Key constituents have identified the need to monitor under ice currents, sedimentation, and potential effects on social systems/subsistence in the vicinity of Northstar and Liberty . Related questions that need to be addressed are the characteristics of major oceanographic and meteorological processes and how they influence the human, marine and coastal environment. One method of collecting oceanographic data that has improved significantly in recent years is through radar mapping and this method is being tested for the Beaufort Sea.

Information on Bowhead Whales and Other Wildlife: Inupiat whale hunters rely heavily on bowhead whales for subsistence. The bowhead whale is central to village cultural and spiritual life. Whale hunters have reported that migrating bowhead whales deflect from their normal migratory route well upstream of active seismic vessels and may divert their migration route far offshore. A concern is that deflection around oil- and gas-industry activity (including drilling activity and associated icebreaker support) forces whales farther and farther offshore, making them harder and more dangerous to hunt. Bowhead

whales also feed along the fall migration route and information about bowhead feeding is needed. Noise from industrial activity is a central concern.

These concerns are addressed in part by ongoing studies such as the MMS Bowhead Whale Aerial Survey Project (BWASP) and the recently completed study titled *Bowhead Whale Feeding in the Eastern Alaskan Beaufort Sea: Update of Scientific and Traditional Information* (OCS Study MMS 2002-012). Analysis of other information on covariance of human activities and sea ice in relation to fall migrations of bowhead whales is underway. It is important to assess the factors that may be affecting the migration routes of bowhead whales.

The populations of bowhead whales, polar bears, beluga whales, spectacled eiders, and other endangered species are an ongoing concern of environmental groups, Federal agencies, and the International Whaling Commission. North Slope villages are particularly concerned about potential disturbance of ringed seals, waterfowl, and other subsistence-wildlife species by oil-industry activities such as helicopter overflights.

Native Culture: The Inupiat believe that their culture is vulnerable to short-term, long-term, and cumulative effects from OCS activities. There are concerns that OCS activities might lead to:

- Social disruption and a change in cultural values through population shifts (immigration of large numbers of non-Inupiat to the North Slope).
- Employment changes (potential effects on subsistence lifestyle by a cash economy).
- Cumulative effects of multiple industrial activities, alteration of subsistence-harvest patterns and displacement of hunters and subsistence resources.

An anticipated decline in oil revenues to the North Slope Borough is an issue of concern also.

The Inupiat rely on a wide variety of marine resources as significant sources of food. In addition, the harvesting, sharing, and consuming of subsistence resources form an important part of the traditional Inupiaq culture and spiritual life. People are concerned that a temporary or permanent elimination of primary subsistence foods would cause North Slope residents either to shift to less desired subsistence resources or to replace subsistence foods with expensive Western foods. The Inupiat are concerned about mitigation, including compensation, for potential losses. There is a need to monitor potential key indicators of socioeconomic and cultural changes on the North Slope.

Another concern is the use of local and traditional knowledge in analysis of potential environmental effects; mitigation measures to protect environmental resources; and general offshore planning, leasing, and regulation of industry activity. We continue to seek and include firsthand knowledge of local subsistence hunters to augment the scientific knowledge base.

Pollutants: North Slope villagers are concerned about potential effects on their food supply. In the Beaufort Sea, such foods include bowhead whales, seals, waterfowl, and

fish. Of particular concern are the fate, behavior, and cleanup of a major oil spill and the potential mortality to marine wildlife in open water or effects resulting from entrainment of oil in sea ice. Related to these concerns, additional information is needed regarding currents that might carry oil under ice. Additional information on ocean currents and sea ice is important to addressing these concerns.

Small portions of the Beaufort Sea floor near the Liberty development unit have a special benthic environment referred to as the "kelp community" or the "Boulder Patch." Sediments or pollutants associated with oil- and gas-industry activities could negatively affect this unique environment.

1.3.2 Chukchi/Hope Basin General Information Needs

Native culture relying on subsistence, particularly on marine resources, predominates in these regions. The fundamental issues in the Chukchi/Hope Basin are very similar to the Beaufort Sea. The major difference is that the last OCS activity in the Chukchi Sea was in the early 1990's and no OCS activity has occurred in the Hope Basin. MMS has conducted studies in the Chukchi/Hope Basin, but with less emphasis since the early 1990's, compared to the Beaufort Sea. As indicated in Section 1.2.1, industry has expressed interest in potential Chukchi Sea leasing and exploration. This Plan includes studies to address environmental information needs in the Chukchi Sea, if needed. MMS has ongoing and recently completed studies relevant to the Chukchi Sea.

1.3.3 Cook Inlet/Shelikof Strait General Information Needs

Physical Oceanography: The MMS Oil Spill Risk Assessment (OSRA) Model needs additional validation in Alaskan waters. One method of collecting oceanographic data that has improved significantly in recent years is through radar mapping and this method will be further investigated for the Cook Inlet. Recent studies have been performed on surface currents in Cook Inlet. But more extensive information on surface currents is needed, particularly in middle and upper Cook Inlet.

Protected Species: A variety of protected species including, but not limited to, Steller's eiders, sea otters, harbor seals, beluga whales and humpbacked whales inhabit lower Cook Inlet and are potentially vulnerable to spilled oil and disturbance from oil development in the OCS. Updated information is generally needed on the distribution and habitat use patterns of these species for OSRA, to evaluate the effects of disturbance and to facilitate planning for potential mitigation. For most of these species, information on distribution and abundance is most complete for the summer season when conditions are most suitable for observation. However, individuals of these species are likely to be locally abundant during all months of the year. Emphasis needs to be placed on surveys and studies of the status of lower Cook Inlet populations that are undertaken during the late-fall, early-spring and winter months.

Social Science and Economics: MMS is planning to collect information on the sharing of subsistence harvest in coastal Alaska and to explore potential visual resource effects from OCS activity in Cook Inlet.

1.3.4 Norton Basin General Information Needs

The last EIS MMS prepared for this area was for Lease Sale 100 in 1984. Sale 100 was cancelled. If MMS initiates NEPA processes for a specific future lease sale in Norton Basin, information in all disciplines will need to be updated. However, the *Final Outer Continental Shelf Oil and Gas Leasing Program 2002-2007* proposes a new approach to leasing in this area. MMS will issue a call for information and nominations and will move forward only if industry nominates blocks and MMS decides to proceed toward a lease sale. A NEPA analysis will not be prepared prior to the request for nominations. As of September 2005 MMS has decided not to continue with a proposed Sale in Norton Sound due to a lack of industry interest. See Section 1.2 Projected OCS Activities for further explanation.

Section 2: Study Profiles

Section 2.1: Study Profiles for

Ongoing Studies

The status of ongoing studies can be found at:

www.mms.gov/eppd/sciences/esp/profiles/alaska.htm.

This website is up dated three times each year and includes:

- An updated status of each study.
- Report due dates.
- Related publications.
- Affiliated websites.

For all completed ESP Studies go to:

mmspub.mms.gov/

This has the Environmental Studies Program Information System (ESPIS). ESPIS provides access to completed study products. It is a searchable, web-based, text retrieval system allowing users to view or download reports.

Region: Alaska

Planning Area: Beaufort Sea

Title: Circulation, Thermohaline Structure, and Cross-shelf Transport in the Alaskan Beaufort Sea

MMS Information Needs to be Addressed: Understanding the physical oceanography of the Beaufort Sea is a necessary precursor to establishing accurate and reliable oil spill trajectory models. Results from such models are an important part of EIS analysis of proposed lease sales and choosing among alternatives. Oil-spill issues involving or resolvable by the trajectory model constitute half the public comments submitted on NEPA documents for decision-making on proposed offshore oil- and gas-lease sales on the Alaska OCS. Study results will be used for NEPA analysis and documentation for the proposed Beaufort Sea Lease Sales and DPP's.

Actual Costs (in thousands):
FY1998 $623
FY2000 $20
Total Cost: $643

Period of Performance: FY 1998-2006

Conducting Organization: CMI, UAF

Description:

Background Current, temperature, and salinity time series are largely unavailable for the Arctic Ocean, including in the Alaskan Beaufort Sea. Forcing and time and space scales are hypothesized rather than identified and confirmed. There are high inter-annual differences in flow and coastal salinity, but insufficient data to decipher whether these differences are due to long term trends or just inherent variability. Although there is salinity, temperature, and other data available for the Arctic Ocean, there is only one full year of cross-shelf mooring data along the Alaskan Beaufort coast. Data from elsewhere in the Arctic Ocean indicate that the oceanographic state of the Arctic Ocean may have changed since the earlier study. This study will provide a second year of data.

Objectives

1. Estimate the mean transport over the outer continental shelf and slope and the cross-shelf and vertical scales of the mean flow field.
2. Estimate the magnitudes of transport variability and the dominant temporal and spatial scales associated with this variability.
3. Estimate the relation between variations in temperature and salinity and variations in the flow field at time scales between the synoptic to the seasonal. Evaluate whether changes in the baroclinic flow are consistent with changes in the cross-shelf density structure.

4. Estimate the cross-shelf fluxes of heat, salt, and momentum. Evaluate whether these are related to instabilities (eddy generation mechanisms) of the littoral flow.
5. Estimate the relationship between observed flow and density variations and the surface wind field.
6. Compare the results obtained from the proposed field program with those collected in 1987/88 in prior MMS research, to evaluate whether recent large changes in the Arctic Ocean are also reflected in the Beaufort Sea.
7. Combine this data set with other measurements recently acquired from around the Arctic Ocean to provide an updated synthesis that relates the Beaufort Sea to the large-scale circulation of the Arctic Ocean.

Methods Moored instruments were deployed along the outer shelf and slope of the Alaskan Beaufort Sea. Five of the moorings were recovered after one year, in 1999. The sixth mooring could not be recovered in 1999, and will be recovered in 2000. The mooring data will be supplemented by hydrographic profiles collected during the mooring deployment and recovery cruises on a cross-shelf transect along the 147° W meridian.

Date Information Required: The final data sets are due December 2005.

Revised date: September 2005

Region: Alaska

Planning Area: Beaufort Sea

Title: Synthesis and Collection of Meteorological Data in the Nearshore Beaufort Sea: Extension

MMS Information Needs to be Addressed: The MMS uses circulation models requiring meteorological information in EIS's, other environmental assessments, and oil-spill contingency planning. The database will used in validating the 10 m wind fields that the MMS uses in the Arctic Regional Circulation Model and Oil Spill Trajectory Analysis. The data from this study will also be used with future planned MMS efforts in FY2004 through FY2007 to collect surface current measurements within this study area using High Frequency Doppler radar and to develop a mesoscale meteorology model for the Beaufort Sea.

Actual Cost (in thousands)**:**

FY 2000	$210
FY 2003	$99
FY 2004	$110
FY 2005	$130
FY 2006	$110
FY2007	$ 48
Total Cost:	$707

Period of Performance: FY 2000-2007

Conducting Organization: Hoefler Consulting Group

Description:

Background Future development in the Alaska OCS will be in the nearshore region of the Beaufort Sea. Presently, the Northstar Oil Field, a joint State of Alaska and Federal offshore lease, produces over 70,000 barrels of oil per day from beneath the Beaufort Sea seabed. The oil is carried ashore via buried sub seabed pipeline and connected to the larger North Slope pipeline and processing facilities. MMS is collecting a multi-year wind time-series data from five meteorological stations along the central Beaufort Sea coastline, encompassing the Northstar Oil Field and the proposed Liberty production prospect to the east. Four stations are located at current North Slope oil fields (Milne Point, Endicott, Northstar Production Island, and Badami), and a fifth on Cottle Island, a remote site without local power or road access. The Cottle Island meteorological station was deployed in August 2002 after a large processing facility was installed on the Northstar production island causing some potential interference to the collection of wind speed and wind direction data. All stations have been collecting data since January 2001, with the exception of Cottle Island which started collecting data in August 2002.

We know from Kozo's research in the 1970's and 1980's that the upper air pressure fields, on which modeled wind fields used in Arctic regional circulation models are based, give increasing inaccurate results for surface winds within 20-30 kilometers of the Beaufort Sea coast. In OCS areas off the contiguous 48 States and in the Bering Sea, MMS has established a network of meteorological buoys to monitor the lower atmosphere over long periods (10 years). Recent CMI studies comparing simulated winds from different Arctic and hemispheric wind models to Pt. Barrow winds are not relevant to this study. This is because along the Beaufort Sea coast towards the east, orographic and sea breeze effects are too great.

An additional two years (2005 and 2006) of wind time series data (six continuous years) will provide a long term record that can be used to verify the MMS nearshore circulation model currently under development. In addition, these stations will be used to verify the surface current measurements collected by high frequency Doppler radar planned for the spring, summer and fall of 2005 and 2006. Lastly, these stations along with the other coastal stations at Barrow, and Barter Island will provide important regional wind speed and direction data for the development of the MMS mesoscale meteorological model study planned for the future.

Objectives The objectives of this study are to continue to collect meteorological data in Beaufort Sea locations subject to current and proposed development. This study will add an additional two years of data. This study will develop a wind time series for oil weathering models and sensitivity testing of MMS's nearshore and general regional circulation and trajectory models for the Beaufort Sea. It will support future efforts in the Beaufort Sea to collect surface current measurements from HF Doppler radar.

*Method*s The methods of this study are to:

1. Continue to collect wind time series data from Northstar, Endicott, Milne Point, Badami, and Cottle Island through September 30, 2006
2. Conduct cross-correlation statistical analysis of wind time-series data from Barrow, Deadhorse, Northstar, Endicott, Milne, Badami, Cottle Island and other relevant data sets.
3. Synthesize all existing North Slope meteorological station data from 2001 through 2006 into an MMS-compatible database.

Date Information Required: A final synthesis of information is due January 2006.

Revised date: September 2005

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDIES PLAN 2006

Region: Alaska

Planning Area: Beaufort Sea

Title: Beaufort Sea Nearshore Currents

MMS Information Needs to be Addressed: This study will be useful to MMS to validate the oil spill risk analysis model. It will provide understanding for oil spill contingency planning in areas outside the barrier islands versus inside the barrier islands. This information will be used to evaluate oil spill contingency plans for Liberty, if approved, and other developments. It would also be used for NEPA analysis and documentation for Beaufort Sea Lease Sales and DPP's.

Actual Costs (in thousands):
FY 2003: $300
FY 2004: $198
FY 2006: $107
Total Cost: $605

Period of Performance: FY 2003-2008

Conducting Organization: UAF, Institute of Marine Science

Description:
Background Understanding the under-ice and open water currents through a long term time series is a necessary precursor to estimating potential effects on sensitive resources from oil spills or in the landfast ice. A recent MMS study provided measurements from three locations within the barrier islands of Stefanson Sound near Northstar and Liberty for 1999-2000, 2000-2001, and 2001-2002; and from a fourth location just outside the barrier islands in 2001-2002. The ongoing study has provided the first current, temperature, and salinity data covering the entire freeze up, winter, and breakup periods in the nearshore Beaufort Sea. Preliminary evidence suggests that in the future, a single mooring would suffice in capturing the along-lagoon flow in this region of Stefanson Sound.

Other areas of the Beaufort Sea have different current regimes and have not been sampled for under-ice currents and only limited open water currents. Lagoons in the eastern Alaskan Beaufort Sea have narrower passes between the barrier islands, causing a pulsed circulation in and out of the lagoons. These passes are important due to their potential to funnel flow and oil spills into the lagoons. Camden Bay, also to the east, is not protected by barrier islands and represents a third type of coastal flow regime. The only current meter moorings for these eastern Beaufort Sea coastal regimes were a small oceanographic program in summer 1988 and 1989.

Objectives

1. Measure currents, temperature, and salinity hourly at three locations in the landfast ice zone; one in the vicinity of Liberty and Northstar and two in new locations with different flow characteristics.
2. Quantify the magnitude of current variability and to describe the relationship between currents and local winds.
3. Estimate the vertical structure of the currents throughout the water column and how the structure changes with the development of the landfast ice through the winter and in summer when the ice melts and rivers flood the inner shelf.
4. Provide physical oceanographic data to the continuation of the Arctic Nearshore Impact Monitoring in Development Areas (ANIMIDA) study.

Methods

1. A 1200 kHz acoustic Doppler current profilers (ADCPs) will be moored for one-year periods, recovered, and redeployed for total of 3 years. All three moorings will have conductivity temperature depth measuring devices (CTD's) and transmissometers.
2. Any mooring outside the barrier islands will require acoustic modem technology to allow periodic winter downloading of data from the mooring.
3. Local winds measured at Deadhorse, Northstar, Endicott, Oliktok and Badami and sea level data collected at the Waterflood facility will be collated for time-series comparison with mooring data.
4. Standard physical oceanographic time-series analyses (e.g., univariate statistical descriptors and correlation in both time and frequency domains) and velocity shear calculations will be done.

Date Information Required: Annual reports are due 2005, 2006, and 2007. The final analyses are due July 2008.

Revised date: September 2005

Region: Alaska

Planning Areas: Beaufort Sea

Title: Mapping and Characterization of Recurring Spring Leads and Landfast Ice in the Beaufort Sea

MMS Information Needs to be Addressed: New information on both the temporal and spatial aspects of landfast ice is the foundation for improving the oil spill risk analysis. Monthly winter landfast ice location would be a significant improvement over a seasonal winter location in use today. In addition this information is useful for validating ice models. This study meets an ongoing need for future sales, oil spill contingency planning, and for NEPA analysis and documentation for Beaufort Sea Lease Sales and DPP's.

Actual Costs (in thousands): **Period of Performance:** FY 2003-2006
FY 2003: $388
Total Cost: $388

Conducting Organization: UAF, Geophysical Institute

Description:
Background Spring leads in the Beaufort Sea occur every year to the east of Barrow. The size, frequency, and latitudinal extent of these leads, particularly further east from Barrow, are poorly known. In recent years, we have become aware that the Arctic Ocean, and especially the Beaufort Sea, responds to alternating climate states lasting a few to several years. A primary difference between the two alternating states is a weakening or reversal in the Beaufort gyre. Superimposed on, and interacting with the alternating climate states, is the estimated 40 percent thinning of Arctic ice pack over the last 30 years. The effects of climate state and ice thinning on spring lead characteristics in the Beaufort Sea are unknown.

Better information on how spring leads and moving ice pack interact is another issue, because this interaction is the key to how much risk spilled oil encapsulated in pack ice has to localized biota. Bowhead whales migrate past Barrow along these leads and westward, toward the Canadian Beaufort in the spring. The leads are also heavily used by spring migrating waterfowl. Risk from encapsulated oil would be less if the ice pack diverges along the lead lines as opposed to breaking up and crossing the leads.

The spatial location of landfast ice on a monthly basis is known in only a very generalized sense as shown in climatic or ice atlases. The new MMS sponsored sea ice atlas is being developed from the Joint Ice Center products, which are at a 25 km grid resolution and are too coarse for the detail needed. The spatial distribution of landfast ice was documented in the Beaufort Sea by Stringer in the mid 1970's on a seasonal basis.

The seaward limit of stable fast ice defines where under-ice pooling of spilled oil might take place and where fast ice conditions apply to design and operation of offshore facilities. It defines the location where no ice movement occurs. It is also the extreme landward boundary of possible whale migration routes during the springtime migration period.

Objectives

1. Document locations of recurring spring leads to the east of Barrow, and their extent across the Alaskan Beaufort Sea.
2. Document temporal and spatial occurrence of shoreward landfast ice line across the Alaskan Beaufort Sea to the Canadian McKenzie Delta.
3. Examine the effect of climate on lead and landfast ice characteristics.
4. Examine the effect of ice thinning on lead and landfast characteristics
5. Document dominant spring lead/ice pack interaction mode(s).
6. Map average monthly shoreward land fast ice line.

Methods

1. Review and synthesize literature and local information sources.
2. Synthesize and analyze current and historical remote-sensing imagery of recurring spring leads and shoreward landfast ice line.
3. Create geographic information system files summarizing the spatial distribution of spring leads in the Alaskan Beaufort Sea. Provide individual years as well as statistical representation of lead occurrence and distribution.
4. Create geographic information system files showing the monthly distribution of the shoreward landfast ice line across the Alaskan Beaufort Sea to the Canadian McKenzie Delta.
5. Provide individual months per year as well as statistical representation of landfast ice occurrence and distribution.
6. Provide relevant attributes to spatial data for use in a geographic information system.

Date Information Required: The final information data sets are due October 2005.

Revised date: September 2005

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDIES PLAN 2006

Region: Alaska

Planning Areas: Beaufort Sea, Cook Inlet

Title: CODAR in Alaska

MMS Information Needs to be Addressed: The Oil Spill-Risk Analysis (OSRA) is a cornerstone to regional EIS's environmental assessments, and oil-spill-contingency planning. MMS is being tasked with providing circulation and oil-spill-trajectory information at higher resolution than feasible or justifiable by state-of-the-art modeling or current-meter technology. Results for the study will be used for NEPA analysis and documentation for Beaufort Sea Lease Sales, Cook Inlet Lease Sales, and in reviewing and improving oil-spill-contingency plans, including any for the Liberty project, if approved and constructed.

Actual Costs (in thousands): **Period of Performance:** FY 2003-2006
FY 2003 $59
Total Cost: $59

Conducting Organization: University of Alaska Fairbanks

Description:
Background Over the past 25 years, oceanographic radar techniques have been developed and improved so that detailed, gridded, two-dimensional maps of surface circulation can be provided and recorded in real time. There is a paucity of direct circulation measurements in the Beaufort Sea and Cook Inlet. Current meters provide only data at specific points and not at the water surface, where spilled oil would be. These radar techniques provide a measured equivalent of a gridded circulation model and can be used as input to and validation for spill trajectory models. Coastal Ocean Dynamics Application Radar (CODAR) was partially developed in work for MMS in Cook Inlet two decades ago, but that developmental system did not provide useable data. More modern radar systems have been successfully used since in MMS-funded studies in offshore North Carolina, Central Gulf of Mexico and offshore Southern California. UAF has recently been testing CODAR in Cook Inlet, looking at its potential for more remote deployment.

Objectives This study's objectives would be to implement Cook Inlet radar mapping strategies and to investigate the issues with implementing such a system in the Beaufort Sea.

Methods

1. Investigate use of a bistatic CODAR system to lower cost, increase radar range, cut power requirements, and reduce need for remote telemetry links.

2. Provide MMS information on operational issues and successes found in UAF test deployments of 4 CODAR units in Cook Inlet.
3. Test remote power and data transmission capabilities for Cook Inlet CODAR units.
4. Compare initial results with existing data, local knowledge, and models.
5. Present study results at MMS "Surface Circulation Radar Mapping in Alaskan Coastal Waters: Planning/Feasibility" Meeting

Date Information Required: A final report is due October 2005.

Revised date: September 2005

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDIES PLAN 2006

Region: Alaska

Planning Areas: Beaufort Sea, Cook Inlet

Title: Surface Circulation Radar Mapping in Alaskan Coastal Waters: Field Study Beaufort Sea and Cook Inlet

MMS Information Needs to be Addressed: The Oil-Spill-Risk Analysis (OSRA) is a cornerstone to regional EIS's environmental assessments, and oil-spill-contingency planning. MMS is being tasked with providing circulation and oil-spill-trajectory information at higher resolution than feasible or justifiable by current modeling state-of-the-art or current-meter technology. Information from this study will be used in NEPA analysis and documentation for Beaufort Sea Lease Sales, Cook Inlet Lease Sales, DPP's, and oil-spill-contingency plans.

Actual Costs: (in thousands):
FY 2004: $535 (MMS Portion)
FY 2005: $115 (MMS Portion)
Total Cost: $650

Period of Performance: FY 2006-2008

Conducting Organization: UAF

Description:
Background Over the past 25 years, oceanographic radar techniques have been developed and improved so that detailed, gridded, 2-dimensional maps of surface circulation can be provided and recorded in real time. Currents would play a critical role in the transport and fate of spilled oil, but there is paucity of direct circulation measurements in some areas of the Beaufort Sea and Cook Inlet. Current meters provide only data at specific points and not at the water surface, where the oil would be. These radar techniques provide a measured equivalent of a gridded circulation model and can be used as input to and validation for oil spill trajectory models.

Several entities, including MMS, NOAA, NOPP, IOOS, the University of Alaska Fairbanks, and oil industry have expressed interest in using circulation mapping radar techniques in Alaskan coastal waters. The radar units are expensive and cost and use-sharing rental agreements among multiple users is a preferred approach. This study presumes the development of a users group to cost and use sharing of radar units under a prior Feasibility Study.

Objectives This study's objectives would be to implement the Beaufort Sea and Cook Inlet radar mapping strategies in testing specific research hypotheses.

Methods

1. Formulate hypotheses for testing.
2. Implement a radar mapping strategy for Beaufort Sea.
3. Implement a radar mapping strategy for Cook Inlet.

Date Information Required: A final radar mapping strategy for the Beaufort Sea and Cook Inlet is due July 2006.

Revised date: September 2005

Region: Alaska

Planning Area: Beaufort, Chukchi, Bering and Cook Inlet

Title: Alaska Sea Ice Atlas

MMS Information Needs to be Addressed: MMS will be better able to review development and production plans with the most up-to-date ice data. The maximum and minimum dates for ice formation and earliest and latest dates for projected use of ice leads are important variables in these plans. The study will provide information for NEPA analysis and documentation and DPP's.

Actual Costs (in thousands): **Period of Performance:** FY 2000-2006
FY 2000 $195
Total Cost: $195

Conducting Organization: UAA

Description:
Background The most recent compilations of ice data information for the U.S. Beaufort Sea include atlases done in 1983 and 1984. In 1995, a digitized, unclassified hardcopy sea ice chart archive for the period 1972-1984 became available. The charts were digitized as vector data, and then converted to ASCII gridded fields in the World Meteorological Organization's Sea Ice in Gridded Format. These data have 25 km resolution. Biweekly ice coverages are currently available in ARC/INFO for the years 1996-1999. Digital files of historical records may also exist for the Beaufort Sea. Historical records of summer ice severity in the Alaskan Beaufort now date back to 1952 (44 years). Evidence shows that the 1990's have produced mild summers in keeping with warmer record temperatures worldwide. These changes in temperature need to be factored into MMS Beaufort Sea activities, both for lease sales EIS's and subsequent exploration or development and production activities. These conditions must be included in an updated modern summary of ice condition in the Beaufort Sea and along the Alaskan coast. Information has not been updated or consolidated since the mid-1980's. The budget for this study assumes 25 percent participation from other interested agencies.

Objectives The goal of the study is to provide accurate high resolution digital sea ice products for the Beaufort Sea. The data will be used to evaluate ice conditions for current and proposed oil and gas development plans, review exploration plans, and for EIS's. The sea ice data will be incorporated into the MMS environmental database, accessible by ARC/INFO/ArcView.

Specific objectives include:

1. Compiling and quantifying sea ice data collected from the 1970's through the 1990's into digital and geospatial formats.
2. Providing up-to-date description of Beaufort Sea ice environment for ongoing and future activities.

Methods

1. Inventory existing reports, databases, and baseline studies.
2. Formulate a design plan for ice subjects of key interest, mapping requirements; tables; graphs, and other software enhancements which best portray information needs (i.e., ice growth, frequency of ice invasions, etc.) in user-friendly manner.
3. Prepare updated digital atlas which includes maps, tables, and graphs to cover: fast ice stability and ice movements (late May to early September); summer nearshore ice invasions (September to September) and ice growth during winter (December to April).
4. Prepare a retrievable database of sea ice coverages, user interface and analysis tools in Arc/Info.

Date Information Required: The final digital atlas and database is due October 2005.

Revised: September 2005

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDIES PLAN 2006

Region: Alaska

Planning Area: Beaufort Sea

Title: Workshop on Hydrological Modeling of Freshwater Discharge from the Alaskan Arctic Coast

MMS Information Needs to be Addressed: There is a strong need to focus on hydrological observations and processes to evaluate river runoff processes along the Arctic coast. These include terrain elevation, terrain ground cover, precipitation, snow drifting, and melting. The fresh water input is important locally for several reasons: it controls breakup of nearshore ice; it may affect timing of release of particulates (or spilled oil, if present) from landfast ice; and it defines the water mass properties and dynamics of the nearshore shelf, particularly within or near barrier islands. This inshore area is the area of highest interest to oil industry. The information will be used in NEPA analysis and documentation for Beaufort Sea Lease Sales and DPP's

Actual Cost (in thousands): **Period of Performance:** FY 2004-2006
FY 2004 $78
Total Cost $78

Conducting Organization: CMI, UAF

Description:
Background The workshop will bring together the leading experts to discuss the present status and future direction of high resolution, basin-scale and regional hydrological modeling. The workshop will focus on precedents in data processing, hydrological modeling, and field observations, including needs, scientific and economic issues, and possible solutions in this region. The workshop will be designed to include interdisciplinary research such as hydrology, meteorology/climate, and oceanography. The workshop will produce recommendations on the hydrological modeling approaches based on the current research in the polar and subpolar regions.

Due to budget cuts, the USGS reduced its number of river gauges, including those located in Alaska watersheds. However, there are still six sites remaining in the North Slope region, according to NOAA.: the Kuparuk River, the Colville River at Umiat and at the river mouth, the Ikpikpuk River near Barrow, the Sagavanirktok River, and Fish Creek. A vast region remains ungauged. The percentage of the discharge in Alaskan Arctic that drains from these ungauged basins has not been quantified. Thus, there is a great need to focus on the existing hydrological observations and known processes to quantify river runoff along the Arctic coast. Known factors influencing runoff include terrain elevation, terrain ground cover (vegetation types), precipitation, evapotranspiration, soil type and permafrost distribution, snow drifting and melting, and glacier melting. The hydrology of the North Slope of Alaska is somewhat unique due to complexities associated with permafrost hydrology such as active layer development, and

accumulation and melt of snow, glaciers and aufeis. The relatively low gradient watersheds on the coastal plain in some sense buffers the headwater basins of the Brooks Range, yielding important interactions that must be correctly quantified and simulated to accurately predict regional runoff. The freshwater input is important locally because it controls breakup of nearshore fast ice, migration patterns of terrestrial and nearshore contaminants, and defines the water mass properties and density-driven ocean currents of the nearshore shelf, such as coastal current along the Alaskan Arctic coast.

A high resolution, large-scale digital elevation based hydrological model may fill the gap between the small-scale observation studies and large-scale, coarse-resolution modeling. Therefore, it is an especially appropriate time for this workshop to put forward new ideas to stimulate a fresh modeling effort in the region.

Objectives The objective of this project is to summarize the status of hydrological observations, data analysis, and modeling of freshwater discharge (including river runoff from numerous creeks and streams due to snow and glacier melting) in the North Slope region. The workshop will summarize the present status of hydrological observation and modeling, and discuss the scientific questions and possible solutions. The rationales for implementing a high-resolution digital elevation based hydrological model will be addressed, which will incorporate the first-order hydrological processes (precipitation, energy balance, aquifer/land processes) to estimate freshwater discharge into the Arctic Ocean primarily along the Beaufort-Chukchi Sea coast.

Methods

1. The workshop will promote discussion of the following topics in North Slope or other regions similar to the North Slope:
   a. Hydrological observations: remote-sensed and in-situ data analysis.
   b. Hydrological modeling: basin to pan-Arctic scales.
   c. Climate pattern (temperature/precipitation): forcing and feedback oceanography/sea ice, e.g., relationship to hydrology.
2. The organizers/steering committee will select a number of papers for oral presentation on each of the primary topics, including one invited speaker at each session. Other papers will be selected as poster, and time will be made available for a dedicated poster session, including a brief oral introduction of all posters.
3. A list of recommendations for future research will be made to MMS as part of Final Workshop Report.

Date Information Required: The workshop was held October 7-8, 2004 at the University of Alaska Fairbanks and a workshop report is due in October 2005.

Revised date: September 2005

Region: Alaska

Planning Areas: Beaufort Sea, Chukchi Sea

Title: Simulation of Landfast Sea Ice along the Alaska Coast

MMS Information Needs to be Addressed: The Circulation and Oil-Spill-Trajectory Model is a cornerstone to regional EIS's, environmental assessments, and oil-spill-contingency planning. Model results are used by MMS, industry, and other agencies to evaluate the risks and advantages of specific alternatives, and they are used to fine-tune protective lease-sale stipulations. Information from this study will be used for NEPA analysis and documentation for Beaufort Sea Lease Sales, Chukchi Sea/Hope Basin Lease Sales, DPP's, and review of oil-spill-contingency plans for OCS and coastal facilities.

Actual Cost (in thousands):
FY 2004 $40
FY 2005 $40
FY 2006 $40
Total Cost $120

Period of Performance: FY 2004-2007

Conducting Organization: CRREL

Description:
Background The study addresses MMS's need for high-resolution sea ice modeling in the landfast ice zone of the Beaufort and Chukchi Seas. The study will implement a unique sea ice modeling approach developed by CRREL and funded by NASA. The sea ice model uses a Lagrangian-discrete-element-based approach that is well suited to tracking ice trajectories for oil spill transport modeling and simulating ice effects on man-made structures. The model has the ability to vary resolution at sub-kilometer resolution at the coast to 20-30 kilometer resolution in the central basin. This study will cooperate with the state-of-the-art ice modeling MMS Inter-agency Agreement with NASA. Other models available to or being developed by MMS have or anticipate problems with modeling the landfast ice regime where oil development is occurring in Beaufort Sea.

Objectives Develop a nearshore Beaufort Sea ice model for the landfast ice zone:

1. Construct a high-resolution model for simulation of the Beaufort Sea coastal landfast zone based on the existing CRREL/NASA Lagrangian Arctic Basin sea ice model.

2. Demonstrate the model through a series of simulations of sufficient duration to encompass a range of processes from formation to break-up.

Methods

1. Employ kilometer or sub-kilometer resolution at the model coast in the region of interest and 20-30 kilometer resolution in the remainder of the basin.
2. The model region will be a 100-200 kilometer section of the Beaufort Sea coast and extending 50-100 kilometers offshore.
3. As available, the sea ice model will incorporate high-resolution ocean currents in the region of interest, to be obtained from other MMS studies. Coupling issues will be addressed.
4. A coast line data set will be discretized by CRREL at sub-kilometer resolution from remote sensing images. The model will incorporate available bathymetry.

Date Information Required: Annual reports will be provided in FY 2005 and 2006. A final report will be completed in FY 2007.

Revised date: September 2005

Region: Alaska

Planning Areas: Beaufort Sea, Chukchi Sea, Hope Basin

Title: Sea Ice Modeling for Nearshore Beaufort and Chukchi Seas

MMS Information Needs to be Addressed*:* The importance to the MMS is to increase the accuracy of estimates of oil spill movement in ice in the Beaufort and Chukchi Seas. Current models are suspect inshore and to a 100-km to few-km resolution. This study will help resolve modeling issues for the Alaska OCS Region, increase confidence in the models used by the OCS Program, and help in review of oil-spill-contingency plans. The information will also be used for NEPA analysis and documentation for Beaufort Lease Sales and DPP's.

Actual Costs (in thousands):
FY 2003: $200
FY 2004: $200
FY 2005: $200
FY 2006: $200
FY 2007: $200
Total Cost: $1,000

Period of Performance: FY 2003-2007

Conducting Organization: NASA

Description:
Background The MMS used the results of the FY 2002 sea ice modeling workshop to focus on what MMS needs from this next-generation effort addressing the specific problem of modeling fine scale ice/ocean and ice/ice interactions.

Most basin-scale dynamic-thermodynamic models in general use relatively simple thermodynamics and ice thickness distribution approximating the ice as slabs of a one to few meters mean thickness plus open water. While sufficient as a first approximation of the arctic ice pack, such treatment lacks the ability to sufficiently resolve the spectrum of ice thickness from thin new ice to thick ridged ice to fast ice that have been observed. The ice models in current state-of-the-art coupled ice/ocean models, including those current Rutgers and CMI models contracted by MMS, are based on empirical ice physics valid at a 100-km scale and extrapolated to smaller grid dimensions. Even at the larger scale, new satellite remote sensing data demonstrates that the first order physics of lead formation is not correctly depicted in existing ice models.

Development of this next-generation ice model is being jointly funded through an interagency agreement with the National Atmospheric and Space Administration. Some aspects of the model are being developed under separate, additional funding by the National Science Foundation and Office of Naval Research. For MMS purposes, this

new generation ice model would need to improve modeling of spatial resolution, fracture patterns and ice formation, better track observed ice interactions, and lead toward better modeling of nearshore interactions.

Objectives The objective of this study is to improve the state of the art in ocean-ice or ice modeling and to produce either a stand alone ice/ocean model or an improved ice model that can be coupled to and or nested in the current MMS ice/ocean model. The existing or new model would be applied to the nearshore Beaufort and Chukchi Seas.

Methods

1. Participate in interagency working group to co-fund new generation ice model.
2. Develop new ice model based on smaller scale parameterization.
3. Produce stand-alone ice/ocean model or couple the ice model to the current MMS ocean model.
4. Run coupled model simulations.
5. Conduct sensitivity testing and validation of the model results.

Date Information Required: Annual reports are due 2005 and 2006. The final model and results are due July 2007.

Revised date: September 2005

Region: Alaska

Planning Area: Cook Inlet

Title: Water and Ice Dynamics of Cook Inlet

MMS Information Needs to be Addressed: This project will enable MMS to improve its oil-spill risk modeling applied to Alaskan waters. This in turn will enhance the credibility of MMS Cook Inlet EIS's and related NEPA analysis and documentation. Public acceptance of OSRA results and analyses will be enhanced if accompanied by supporting drifter data for Alaskan waters.

Actual Costs (in thousands):
FY 2002 $617
FY 2004 $323
Total cost: $940

Period of Performance: FY 2002-2006

Conducting Organization: CMI, UAF

Description:
<u>*Background*</u> The Cook Inlet tidal regime is among the most complex in the United States because of the large tidal range, extensive mud flats, strong currents, severe weather, and seasonal ice cover. Most physical oceanographic data supporting the model is derived from a comprehensive NOAA circulation survey of Cook Inlet carried out from 1973-1975. A few modest Lagrangian surface current studies have been performed in the Cook Inlet/Shelikof Strait. One study involved releasing drifters in and near Kachemak Bay as documented in 1977; another, released drifters from lower Cook Inlet, was documented in 1981; and another involved releasing drifters in the lower Shelikof Strait. The latter study released a small number of oil-spill-simulating drifters for the purpose of testing how well these drifters would follow an actual oil spill, in this case the *Exxon Valdez* spill.

The MMS has used a variety of ocean models to estimate water and oil movement in Cook Inlet. Most recently, MMS has used an in-house version of the Princeton Ocean Model. In 1999 MMS co-sponsored a Cook Inlet oceanography workshop which recommended that Cook Inlet models be improved and validated in parallel with acquisition of improved observational data.

<u>*Objectives*</u> The objective of this work is to successfully simulate the sea ice and water dynamics in Cook Inlet and validate the simulations with observational data.

<u>*Methods*</u> A combination of 2-d models and a 3-d model, the Regional Ocean Model System (ROMS) because it has been configured to Cook Inlet, will be used and compared to observational data. An improved Cook Inlet bathymetry needed for the modeling has

been obtained from commercial and government sources. Scatterometer satellite observations will provide winds to the models. Drifters are a primary data source. These include oil-following drifters provided by MMS and water following drifters with combined GPS and ARGOS capabilities. SAR imagery is being obtained concurrent with drifter and other field measurements to obtain broad scale information on tide rips.

Date Information Required: A final report is due February 2006.

Revised date: September 2005

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDIES PLAN 2006

Region: Alaska

Planning Areas: Cook Inlet

Title: High-Resolution Numerical Modeling of Near-Surface Weather Conditions over Alaska's Cook Inlet and Shelikof Strait

MMS Information Needs to be Addressed: These results are important for NEPA analysis and documentation for Cook Inlet Lease Sales and DPP's and in reviewing oil spill contingency plans.

Actual Costs (in thousands): **Period of Performance:** FY 2003-2006
FY 2003 $300
Total Cost: $300

Conducting Organization: CMI, UAF

Description:
Background Along the north Gulf of Alaska coast, terrain plays an important role in determining local weather. The interaction of terrain with synoptic and mesoscale pressure gradients frequently produce gap and channel winds, often called low-level jets in places like Cook Inlet and Shelikof Strait. These winds may at times be quite strong, with gusts occasionally exceeding 50 meters per second. These winds are not currently included in existing wind modeling products used to drive Cook Inlet circulation and oil spill models. Low-level wind jets occur in Cook Inlet and Shelikof Strait but are not captured by currently used wind products. Such jets affect oil spill trajectories to unknown degree. This study will provide high resolution wind fields incorporating the jets which will improve the reliability and accuracy of MMS's circulation and spill trajectory models in Cook Inlet and Shelikof Strait.

Objectives Develop an atmospheric modeling capability for the Cook Inlet/Shelikof region suitable for nowcast/forecast and research purposes. Use the model to:

1. Systematically study low-level wind jets and other wind and precipitation phenomena in Cook Inlet and Shelikof Strait.
2. Develop an understanding of the mechanisms which drive low-level wind jets in the region.
3. Develop a climatology of low-level jet occurrence and likelihood in wind-prone locations.
4. Study the vertical and thermal structure of wind jets.
5. Study the cloud fields and precipitation associated with high wind events in the region.

Methods The modeling will use the parallel computing capability being developed at the Alaska Experimental Forecast Facility in Anchorage. An automated modeling system

will run daily, using current initialization data that comes to the facility via a dedicated T1 line from the National Weather Service in Alaska. The model will produce real time, three-dimensional data sets of winds, pressure and temperature throughout the troposphere and lower stratosphere. Accurate topography and nested, finer grids in preliminary model runs result in development of the jets.

Date Information Required: A final model is due July 2006.

Revised date: September 2005

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDIES PLAN FY 2006

Region: Alaska

Planning Areas: Cook Inlet

Title: Physical Measurements and Seasonal Boundary Conditions for Cook Inlet, Alaska

MMS Information Needs to be Addressed: Information will be used for NEPA analyses and documentation for Cook Inlet Lease Sales and to enhance further circulation and trajectory models.

Actual Costs (in thousands):
FY 2002 $26
FY 2003 $10
FY 2004 $172
Total Cost: $198

Period of Performance: FY 2003-2007

Conducting Organization: CMI, UAF

Description:

Background

Improved understanding of density-driven and other circulation in Cook Inlet is needed for development of more sophisticated oil spill models. Present oil spill models for Cook Inlet are two dimensional and lack sufficient data in Cook Inlet to develop more useful three dimensional models. That is, they model only surface distribution of an oil spill. Developers of local numerical circulation/spill trajectory models and planners of Geographical Response Strategies need physical measurements by which their respective models and operational plans can be validated and improved.

Objectives

1. Measure Cook Inlet temperature, salinity, and hydrography from which the density-driven, geostrophic and other circulation within the inlet can be derived.
2. Deploy drift cards whose deployment locations will be used as input to the CIRCAC numerical spill trajectory model for simulations of point source spills and whose recovery locations will then be compared to the grounding locations of the simulated spills.
3. Involve local high school science classes in the reparation, field work/data acquisition and data analyses for temperature and salinity measurements.
4. Measure seasonal changes in volume and property fluxes at the inflow and outflow boundaries in Cook Inlet.

Methods

1. Schedule spring and late summer sampling periods to correspond to period of increasing and diminishing fresh water runoff into Cook Inlet.
2. CTD casts at 1-2 nautical mile spacing along ~20-40 km offshore transects near participating high schools.
3. Take additional CTD cast along the transect on each side of visible fronts.
4. Plot cross sections and surface maps of the temperature, salinity, density, and geostrophic velocity (dynamic topography) fields after the spring, summer and fall hydrographic surveys.
5. Acquire seasonal hydrographic and velocity measurements along transect lines crossing Kennedy Entrance, Stevenson Entrance, Shelikof Strait, Cook Inlet (Red River to Anchor Point), Kachemak Bay (Barbara Point to Bluff Point) and at the Forelands.
6. Analyze data and report properties.

Date Information Required: First reports for Objectives 1-3 are due October 2005; a final report for objective 4 is due July 2007.

Revised date: September 2005

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDIES PLAN 2006

Region: Alaska

Planning Area: Beaufort Sea

Title: Trace Metals and Hydrocarbons in Sediments of Beaufort Lagoon, Northeast Arctic Alaska

MMS Information Needs to be Addressed: This study will increase a baseline of existing sediment conditions along the Alaskan Beaufort Sea for monitoring potential effects of offshore oil and gas activities. Findings will increase knowledge of the mechanisms of environmental change. Study results will be used for NEPA analysis and documentation for the proposed Beaufort Sea Lease Sales and for DPP's.

Actual Costs (in thousands) **Period of Performance:** FY 2003-2006
FY 2003 $167
Total Cost: $167

Conducting Organization: CMI, UAF

Description:
<u>*Background*</u> For comparison to OCS development areas, it is important to establish measurements of trace metals and hydrocarbons in sediments of Beaufort Lagoon, located at the eastern margin of the Alaskan Beaufort Sea. The lagoon sediments of the North Slope may be a sink for both organic and inorganic anthropogenic compounds. Sediments may serve as transfer pathways to higher trophic levels. Environmental accumulation is of particular concern in the Arctic where marine organisms, being lipid rich, with relatively simple and short food chains and low biodiversity, may be especially vulnerable to bioaccumulations.

<u>*Objectives*</u> The primary objective of this study is to estimate the concentrations of 12 metals (V, Cr, Cu, Ni, Zn, As, Cd, PB, Sn, Ba, Fe and Mn) in the mud fractions (<63 *u*m size) and HG and hydrocarbons in gross sediments of the Beaufort Lagoon that are known to have been exposed to: a) long-term natural oil seepage; b) anthropogenic activities with refined petroleum products input; and c) pristine conditions. This objective will help to develop criteria for detecting metal and hydrocarbon accumulation resulting from marine and other human activities in the Beaufort Lagoon region as well as elsewhere in the Alaskan Beaufort Sea.

<u>*Methods*</u>

1. Use a vanVeen grab sampler to collect sediment samples from the Beaufort Lagoon at 20 selected stations spread over three location types, areas of natural oil seepages, recent impact from human activities, and little or no human impacts.

2. Split samples into 3 sub samples for a) trace metal in mud fraction; b) granulometric and mercury analyses; and c) hydrocarbon analysis.
3. Using statistical analysis, assess the relative abundance of the natural oil seep, refined petroleum, fresh crude oil and natural terrestrial or marine biogenic hydrocarbons in the samples.
4. Examine differences between these samples and North Slope samples from an industrialized (Prudhoe Bay/Colville River) and an urbanized (Elson Lagoon near Barrow) region.

Date Information Required: A final report is due December 2005.

Revised date: September 2005

Region: Alaska

Planning Areas: Beaufort Sea, Chukchi Sea, Hope Basin, Cook Inlet

Title: Empirical Weathering Properties of Oil in Snow and Ice

MMS Information Needs to be Addressed: The Alaska Region of the MMS leases in areas which are ice covered. Better estimates of the weathering of oil in snow and ice are important to further impact assessment and oil spill contingency and response planning. Study results will be used for NEPA analysis and documentation for Beaufort Sea Lease Sales, Cook Inlet Lease Sales, Chukchi Sea/Hope Basin Sales, DPP's, and associated Oil Discharge Prevention and Contingency Plans.

Actual Costs (in thousands) **Period of Performance:** FY 2004-2006
FY 2004 $632
Total Cost: $632

Conducting Organization: MAR Inc.

Description:
Background Oil spill weathering models are used in National Environmental Policy Act (NEPA) analysis as well as Oil Discharge Prevention and Contingency Plans (ODPCPs). The results of these models are used to estimate impacts in NEPA analysis as well as pre-planning for oil spill response. A modest amount of work in the field was done in the 1970's and 1980's on first order physics for oil weathering in ice. Additional studies have continued in the laboratory in the late 1980's and 1990's, but were generally limited to low viscosity, low pour-point oils. We now know that oil weathering is strongly dependent on the specific chemical composition and characteristics of individual crudes. The physical and chemical data required by modern state-of-the-art models (such as the SINTEF oil weathering model used by MMS in Alaska) are scarce, of poor quality, or nonexistent for oil-ice interaction. Such models, therefore, ignore the more difficult aspects of oil-in-ice weathering. Sophisticated measurement techniques currently available would enable precise measurements regarding oil evaporation, spreading, and dispersion in ice (as well as on ice) as a function of oil type and chemistry.

Objectives

1. For low and high pour-point oils, measure emulsification, evaporation, dispersion, spreading, slick thickness, and oil composition in an ice field and snow on top of sea ice.
2. Develop a database on oil weathering in ice fields for use in model validation.

3. Use these data, in concert with other oil-ice weathering data, to validate and enhance or develop new algorithms of oil weathering in ice.

Methods Collect and analyze data on weathering of oil in ice and snow on top of sea ice, including but not limited to evaporation, emulsion, dispersion, spreading and slick thickness. Dependant tasks include developing a dataset from the experimental data for use to validate weathering algorithms and oil weathering models in the presence of ice. Create a database or experimental data set of oil weathering parameters in ice fields and snow. Some of this work should be done with both high and low pour point oils. Liberty crude would be an example of a high-pour crude with pour point above environmental temperatures. Validate or enhance oil in ice weathering algorithms. Include recommendations for new algorithms in the oil weathering model that are validated by the field results.

Date Information Required: A final report is due July 2006.

Revised date: September 2005

Region: Alaska

Planning Areas: Beaufort Sea, Chukchi Sea, Hope Basin

Title: Sea Ice-Ocean-Oil spill Modeling System (SIOMS) for the Nearshore Beaufort and Chukchi Seas: Improvement and Parameterization (Phase II)

MMS Information Needs to be Addressed: The Circulation and Oil-Spill-Trajectory Model is a cornerstone to regional EIS's, environmental assessments, and oil-spill-contingency planning. Model results are used by MMS, industry, and other agencies to evaluate the risks and advantages of specific alternatives, and they are used to fine-tune protective lease-sale stipulations. The MMS is currently using an Arctic basin model with 20-km grid spacing to project oil spill trajectories within 10-km of land for ongoing developmental EIS's. This study will provide a better model resolution. It is critical to continue efforts to improve the art and reliability of circulation and trajectory models used in nearshore portion of the central Beaufort Sea. Information from this study will be used in preparing NEPA analysis and documentation for Beaufort Sea Lease Sales, DPP's, and oil-spill-contingency plans for OCS and coastal facilities.

Actual Cost (in thousands):
FY 2004 $371
FY 2006 $208
Total Cost $579

Period of Performance: FY 2004-2007

Conducting Organization: CMI, UAF

Description:
Background The study addresses MMS's needs in terms of modeling at smaller scales in the Beaufort nearshore. The study will implement recommendations from MMS CMI workshop on small-scale Sea Ice and Ocean Modeling (SIOM) for the nearshore Beaufort and Chukchi Seas held at UAF in August 2002. Recent satellite imagery demonstrates the importance of eddies in the coastal Beaufort Sea and thus the need for smaller scale, eddy-resolving modeling such as proposed here. This study will cooperate with the state-of-the-art ice modeling MMS IA with NASA. The study continues development of a CMI model of the Arctic Basin, focusing on the nearshore Beaufort Sea. MMS adoption of circulation model products for use our leasing program's NEPA documents requires a high degree comfort for MMS modelers doing the adoption or by Regional analysts tasked with coordinating use the resulting Oil Spill Risk Analysis in EIS's and then responding to public comments on that analysis. Other models available to MMS do not resolve the coastal barrier islands in the Beaufort Sea, where oil development is occurring.

Objectives The objective of this study is to implement a finer resolution (1-3 km) stretched grid coupled ice-ocean-oil model in the nearshore Beaufort and Chukchi Seas. The entire model is extended to an existing Arctic and North Atlantic Ocean model and includes an open Bering Strait.

Methods

1. Set minimum model depth to 5 meters, and extend the stretched domain through the 500-m isobath.
2. Parameterize sea ice thickness to represent thin ice, new ice, level ice, rafted ice, rubble ice, and ridged ice.
3. Parameterize the landfast ice, which can be ridged and anchored, based on existing theory and observations.
4. The oilspill model developed during the prior CMI study will be coupled to this SIOMS.
5. Annual review of modeling effort by MMS Modeling Review Board

Date Information Required: Annual reports are due in FY 2005 and 2006. A final report is due in FY 2007.

Revised date: September 2005

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDIES PLAN 2006

Region: Alaska

Planning Areas: Beaufort and Chukchi Seas

Title: Improvements in the Fault Tree Approach to Oil Spill Occurrence Estimators for the Beaufort and Chukchi Seas

MMS Information Needs to be Addressed: The Oil-Spill-Risk Analysis (OSRA) is a cornerstone to regional EIS's, environmental assessments, and oil-spill-contingency planning. This study responds to technical recommendations provided to MMS on the fault tree oil spill risk approach used in Beaufort Sea Multi-Sale EIS. Information from this study will be used in NEPA analysis and documentation for Beaufort Sea Lease Sales, Chukchi Sea Lease Sale, DPP's, and oil-spill-contingency plans for OCS and coastal facilities.

Actual Costs (in thousands) **Period of Performance:** FY 2004-2006
FY 2004 $67
Total Cost: $67

Conducting Organization: Bercha International

Description:
Background The MMS has been estimating the likelihood of Arctic oil spills in Alaska OCS Region EIS's for a quarter century, mostly based on what has happened elsewhere on the OCS. Now that Arctic OCS oil production is occurring, the methodology and validity of the MMS spill estimates used for Arctic OCS areas are increasingly questioned by other government agencies, the public, and oil industry. The standard U.S. OCS historical platform and pipeline crude oil spill estimates are based on the Gulf of Mexico and Pacific OCS experience. This spill record does not include pipeline spills inshore of the OCS, in State waters, or on land. The MMS Alaska OCS Region is examining spill occurrence based on Regional considerations, such as Alaska North Slope and Arctic Canada rather than on the Gulf of Mexico and Pacific OCS experience. We also need to include all major pipeline spills, both onshore and offshore, in environmental risk assessment. The first step in this process was a prior MMS-sponsored study that collated available information on crude and diesel spills of at least 100 bbl from the oil industry in the Alaska North Slope and Arctic Canada; and that estimated provisional occurrence rates for use in the nearshore Beaufort Sea OCS. A second step in this process was a MMS-sponsored study developing fault tree estimates of spill occurrence taking into account (1) differences in risk factors between the Arctic and Gulf of Mexico OCS and (2) Arctic-specific factors.

Objectives The objective is to improve the initial fault tree model approach by:

1. Generating additional model validation and statistical measures from oil spill

statistical data.
2. Providing MMS with fault tree scenarios for environmental assessment of future exploration and development.
3. Providing MMS with user-friendly software to develop scenario-specific fault tree oil spill occurrence estimates for future environmental assessment.

Methods

1. Use the fault tree model of oil spill occurrence to generate additional model validation information from specific non-Arctic scenarios, such as Cook Inlet and Gulf of Mexico projects, which have an oil spill statistical history.
2. Use the model in a sensitivity analysis to identify the importance of different Arctic variables to provide a prioritized list of variables having the highest potential impact on Arctic oil spills.
3. Use Gulf of Mexico OCS historical data together with its measures of spill size variance and setup the Monte Carlo fault tree model to run with these measures of variance.
4. Generalize the model so that it can be run both in an expected value and distributive value (Monte Carlo) form.
5. Expand the fault tree analytical system to include causeway pipelines.
6. Develop fault tree scenarios with risk factors, for Liberty and McCovey environmental assessments.
7. Convert the current fault tree model into a user-friendly software package, which can be used to estimate oil spill occurrence and characteristics for future scenarios. Include modular structure, user manual, online help, password protected parameters and algorithms, and extensive graphical outputs.
8. Provide professional support to MMS in regard to statistical issues of occurrence rates and estimator(s) related to this study and its results.

Date Information Required: A final model and report is due November 2005.

Revised date: September 2005

Region: Alaska

Planning Areas: Beaufort and Chukchi Seas

Title: Updates to the Fault Tree Approach to Oil Spill Occurrence Estimators for the Chukchi and Beaufort Sea Planning Areas

MMS Information Needs to be Addressed: The Oil-Spill-Risk Analysis (OSRA) is a cornerstone to regional EIS's, environmental assessments, and oil-spill-contingency planning. Oil-spill issues constitute a significant portion of public comments submitted on sale or development EIS's in the Alaska OCS Region. This study is necessary to incorporate fault-tree spill occurrence estimators into NEPA analyses for Beaufort Sea and Chukchi Sea oil and gas lease sales or development during the forthcoming MMS 2007-2012, 5-Year Plan.

Actual Costs (in thousands): **Period of Performance:** FY 2005-2010
FY 2005 In procurement, TBD

Description:
Background The OCS spill occurrence rates used in MMS NEPA analyses are based on historical platform and pipeline crude oil spill rates, almost entirely from the Gulf of Mexico OCS. For the Alaska OCS Region Arctic planning areas, the MMS has recently incorporated a fault-tree approach which incorporates (1) differences in oil spill occurrence factors between the Arctic and Gulf of Mexico OCS and (2) Arctic-specific factors. The first MMS-sponsored fault-tree study was finished in 2002. The second, ongoing, fault-tree study *Alternative Oil Spill Estimators for the Beaufort and Chukchi Seas* primarily implements the MMS Scientific Committee recommendations to improve the fault tree application and statistics for Beaufort Sea spill occurrence rates. This second study is scheduled for completion in late 2005.

Objectives To provide:

1. An updated fault tree spill occurrence rates and confidence intervals for NEPA analyses for Chukchi and Beaufort OCS oil and gas Lease Sales or for oil and gas developments during the contract period of performance.
2. A PC program to provide MMS analysts the ability to calculate spill occurrence rates and confidence intervals subsequent to contract period of performance.

Methods

1. Review and assimilate oil spill occurrence data and geohazard data from alternative sources and locations as needed.
2. Use updated Gulf of Mexico OCS historical data together with its measures of spill size and frequency variance and setup the Monte Carlo fault tree model to run with

these measures of variance.

3. Update the Chukchi Sea fault-tree analysis used in the MMS-sponsored study finished in 2002 incorporating the MMS Scientific Committee recommendations and a new MMS exploration and development scenario. Generate life-of-field occurrence indicators.
4. Update the Beaufort Sea fault-tree analysis from the ongoing *Alternative Oil Spill Estimators for the Beaufort and Chukchi Seas* study to match a new MMS exploration and development scenario. Generate life-of-field occurrence indicators.
5. During the period of performance, provide up to two additional Chukchi Sea and up to two additional Beaufort Sea updated fault-tree analyses based on updated MMS exploration and development scenarios.
6. During the period of performance, provide up to two additional fault-tree analyses for Beaufort and/or Chukchi Seas for site-specific oil and gas development taking into account site-specific geohazards. Generate life-of-field occurrence indicators.
7. Develop a PC program, manual, and training necessary to provide MMS analysts the ability to calculate spill occurrence rates and confidence intervals from updated exploration and development scenarios for Chukchi and Beaufort Seas oil and gas lease sales subsequent to contract period of performance.
8. Provide professional support to MMS in regard to statistical issues of occurrence rates and estimator(s) related to this study and its results.

Date Information Required: Information from this study will be needed in FY 2006 for NEPA analysis for the first Chukchi and/or Beaufort Sea Oil and Gas Lease Sale in forthcoming 5-Year Plan.

Revised Date: September 2005

Region: Alaska

Planning Areas: Beaufort Sea

Title: Locating Overwintering Fish Habitat, Colville River /Beaufort Sea

MMS Information Needs to be Addressed: MMS is responsible for identifying and mitigating potential environmental effects of OCS development to marine biological and subsistence amphidromous fish resources. Presently, limited knowledge of actual overwintering sites hinders evaluation of these potential effects. Documenting overwintering sites has not been accomplished because it was prohibitively expensive using previous techniques. Information will be used for NEPA analysis and documentation for Beaufort Sea Lease Sales and DPP's.

Actual Costs (in thousands): **Period of Performance:** FY 2003-2006
FY 2003 $244
Total Costs: $244

Conducting Organization: Battelle

Description:
Background Very little documentation exists on actual overwintering habitat of Beaufort Sea amphidromous fish. Amphidromous fish such as char, cisco, whitefish and grayling depend almost exclusively on Beaufort Sea coastal waters for food. After a brief summer in food-rich coastal marine waters, the fish are believed to retreat to overwintering sites as Beaufort waters turn frigid and inhospitable in fall. Brackish deltas, deep pools, springs, and freshwater lakes are considered the primary overwintering habitats. Whether amphidromous fish overwinter in nearshore areas just outside the shorefast ice is unknown.

Overwintering sites are especially critical to some species because they must occupy these limited sites for two-thirds of the year. Just when inland waters become essential for overwintering they shrink by 98% due to reduced runoff and freezing. By late winter, even the largest rivers cease to flow and freeze to the bottom over long stretches. If the fish are forced to crowd into limited deepwater pockets, the waters could become overcrowded, anoxic, and may freeze. Once the connecting channels freeze solid, the fish would be isolated and unable into more hospitable habitat. Thus, in order to return to coastal environments for the short 2-3 month summer growth spurt, amphidromous fish must survive a minimum of eight months in these pockets, from fall freeze-up to spring breakup. If overwintering also occurs beyond the shorefast ice, then overwintering habitat may not be limiting.

Recently, remote sensing applications such as synthetic aperture radar (SAR) in conjunction with modeling have reduced the potential high cost of evaluating overwintering habitats. Developing methods using these techniques would increase our efficiency in identifying overwintering. A greater knowledge of overwintering sites is critical to protecting critical subsistence and biological resources while developing offshore oil and gas resources.

Objectives

1. Identify probable amphidromous overwintering habitats of the Beaufort Sea.
2. Test remote sensing applications for documenting overwintering habitat.
3. Document presence or absence of overwintering fish inland and beyond shore fast ice.

Methods

1. Identify suspected nearshore amphidromous overwintering sites in test and control areas from local knowledge, literature, and remote sensing data. Choose a river system believed to support extensive overwintering and another river system believed to support little overwintering as a control.
2. Use available remote sensing data such as SAR images, or existing data to estimate location and of amount amphidromous overwintering habitat.
3. Document actual use by remote under-ice photography, diving and/or sampling from onshore pipeline region to beyond shore fast.
4. Evaluate remote sensing tools to identify amphidromous overwintering and estimate cost of documentation across the Beaufort Sea.

Date Information Required: A final report is due July 2006.

Revised date: September 2005

Region: Alaska

Planning Areas: Beaufort Sea

Title: Analysis of Variation in Abundance of Arctic Cisco in the Colville River

MMS Information Needs to be Addressed: Information will be used for NEPA analysis and documentation for Beaufort Sea Lease Sales, oil-spill-contingency plans, facilitation of outreach with North Slope communities, and DPP's.

Actual costs (in thousands): **Period of Performance:** FY 2003-2006
FY 2004 $315 (Phase II)
Total Cost: $315

Conducting Organization: ABR, Inc.

Description:
Background Native Alaskans are concerned that arctic cisco in the Colville River have been less abundant during the last few years than in the years preceding. Considerable research has been conducted on the natural history of the species, with particular emphasis being placed on the potential effect of causeways, constructed during oil development, on migration. The current understanding of the arctic cisco life cycle is that all spawning for the species takes place in the Mackenzie River drainages. The young-of-the-year leave the river during the spring and become entrained in wind-driven currents along the Beaufort coast. If east winds are sufficient and sustained, young fish migrate all the way to the Colville River, where they will spend several years maturing before returning to the MacKenzie River. If winds are not sufficient, they go elsewhere. Thus, migrations of arctic cisco are particularly vulnerable to large-scale changes in oceanic circulation, such as recent suspected changes in the Beaufort gyre, which may lead to modification of the strength and direction of nearshore winds. Nuiqsut villagers are also concerned that drilling muds, spilled underground during the construction of the Alpine pipeline, could be entering the river and have effects on the abundance of arctic cisco. Other factors that could affect arctic cisco populations include, but are not limited to, factors affecting recruitment at the MacKenzie River, changes in the channels of the Colville river and hence the distribution of fish available for subsistence use, fishing practices and harvest, and possibly, the cumulative effects of onshore and offshore oil-related development. A study is needed to further establish the observed trends in arctic cisco abundance and evaluate the factors influencing population variation.

Objectives

1. Access information from subsistence users, fisheries biologists and governmental organizations to develop hypotheses on the variable, or possible declining, arctic cisco abundance in the Colville River and its tributaries.
2. Quantify inter-annual variation in the abundance of arctic cisco in the Colville River and its tributaries.
3. Use a statistical approach to estimate which environmental factors contribute to observed variation in arctic cisco abundance in the Colville River.

Methods

Phase I:

Sponsor a meeting of individuals with traditional and scientific knowledge about arctic cisco abundance and fishing success, stock exploitation, long-term climate related changes, and arctic cisco genetics to identify factors that might contribute to observed variation in arctic cisco abundance and to recommend a study design for further scientific inquiry.

Phase II:

1. Quantify the abundance of fish of various cohorts in the Colville and its tributaries using sampling techniques such as fyke nets.
2. Use existing data, and data from concurrent MMS- and MMS/CMI-funded studies to analyze the effects of changes in oceanic circulation on nearshore wind and related fish migrations between MacKenzie River and Colville River.
3. Review existing data from the MacKenzie River to see if gross changes in arctic cisco stocks have occurred.

During Phase I, the Alaska Region will attempt to seek joint funding from potential co-sponsors, such as the State of Alaska or other Federal agencies with fisheries management responsibilities.

Date Information Required: A final report is due July 2006.

Revised date: September 2005

Region: Alaska

Planning Area: Beaufort

Title: Use of the Beaufort Sea by King Eiders

MMS Information Needs to be Addressed: Because basic biological parameters (i.e., population status, survival estimates, migration routes, and habitat requirements) for king eiders in the Beaufort Sea have been poorly described, assessment of potential impacts of offshore oil development are limited in regard to protecting the species. Increased knowledge of this species could be incorporated with data being collected by the USFWS and the Canadian Wildlife Service to better assess impacts. Results will be used in NEPA analysis and documentation for Beaufort Sea Lease Sales and DPP's.

Actual Costs (in thousands):

FY 2002	$320
FY 2003	$0
FY 2004	$400
FY 2005	$350
FY 2006	$350
FY 2007	$100
Total Cost:	$1,520

Period of Performance: FY 2002-2007

Conducting Organization: CMI, UAF

Description:

Background The king eider population appeared to remain stable between 1953 and 1976. However, a recent analysis by the NSB, of migration counts off Point Barrow, Alaska estimated that king eiders have declined 56% (3.9% per year) from approximately 802,556 birds in 1976 to about 350,835 in 1996. King eiders migrate eastward along the Beaufort Sea during May-June to arctic nesting areas in Alaska and Canada. During molt-migrations in late summer and fall-migration (September-August), eiders move westward along the Beaufort Sea coast to overwintering areas in the Chukchi and Bering Seas. Although migration count data have been collected at Point Barrow intermittently since 1953, little information exists regarding the importance of the Beaufort Sea to king eiders in other locations. Petroleum related exploration and development has the potential to affect king eider populations. For example, the vulnerability of king eiders to an offshore oil spill was verified when an estimated 21,609 $\pm$ 70 king eider carcasses were found on St. Paul Island following an oil spill February 1996. Other effects could result from disturbance of resting or migrating flocks and death of individual birds due to strikes on offshore structures. The first oil development in the Beaufort Sea, Northstar, started production in November 2001 and other development is possible. Additional information on patterns of migration and habitat use for king eiders in the Beaufort Sea

would be useful for predicting the potential impact of petroleum related developments along the Beaufort Sea coastline.

Objectives

1. Document movements and locations of spring, summer and fall migrating adult female king eiders (successful and unsuccessful breeders) marked on breeding areas along the Beaufort Sea Coastline, including Kuparak and NPR-A.
2. Document habitat use and breeding success of females nesting at Kuparak and NPR-A study sites.
3. Describe potential staging and over-wintering areas used during spring and fall migration.
4. Evaluate whether adult female king eiders (emphasis on successful breeders) molt in the Beaufort Sea prior to fall migration to over-wintering areas.
5. Test an extended life, implantable satellite transmitter that uses batteries developed for implantation in human applications; evaluate the potential for development of TDR (time-depth recorder) technology for use on king eiders; test TDR technology if feasible.

Methods This study is a jointly funded activity conducted by the University of Alaska Fish and Wildlife Cooperative Research Unit with key organizations potentially including: MMS, UAF CMI, NSB, USFWS, and Canadian Wildlife Service. The study will use implanted satellite transmitters to evaluate habitat use patterns and locate the migration corridor for king eiders. Female king eiders (60 successful breeders and 60 unsuccessful breeders) and male king eiders (n = 60) will be instrumented with implanted satellite transmitters on their breeding grounds and monitored during periods when they undertake spring and fall migrations. Satellite transmitters will also allow the opportunity to document the rates of migration across Beaufort Sea.

Date Information Required: The final report is due July 2007.

Revised date: September 2005

Region: Alaska

Planning Areas: Beaufort Sea

Title: Foraging Ecology of Common Ravens (*Corvus corax*) on Alaska's Coastal Plain

MMS Information Needs to be Addressed: This study is a collaboration among MMS, the University of Alaska CMI, the North Slope Borough and Phillips Petroleum to address an issue that has been increasing in relevance to environmental assessment of potential effects of oil and gas development. MMS will possibly have to address mitigation needs in the event that structures, pipelines or other factors related to oil or gas development are shown to enhance certain predation. Information from this study will also be useful for analysis of the cumulative effects of offshore development on the fauna of the OCS and Alaskan Coastal Plain. Information will be used for NEPA analysis and documentation for Beaufort Sea Lease Sales and DPP's

Actual Costs (in thousands): **Period of Performance:** FY 2003-2006
FY 2003 $205
Total Cost: $205

Conducting Organization: CMI, UAF

Description:
<u>*Background*</u> The impact of avian predators, including the common raven, on the North Slope has been assumed to be higher in areas with oil development or human habitation due to increased availability of food and nest sites associated with human-made structures. Predator management on the Alaska North Slope is an issue that has arisen in many contexts. For example, the Steller's Eider Recovery Team has recommended killing ravens in Barrow to benefit the threatened Steller's eider (*Polysticta stelleri*), and this recommendation has been implemented to a limited extent. More generally, the U.S. Fish and Wildlife Service has attempted to reduce predator access to human food waste in the oilfields and villages through its authorities under the Clean Water Act.

It is clear that common ravens (*Corvus corax*) on the North Slope are utilizing anthropogenic factors both as nesting sites and to obtain sufficient food to overwinter on the outer arctic coastal plain. However, the associated impact of raven predation on other tundra-nesting birds has not been studied. Data on summer diet and raven productivity are needed to assess whether increased raven numbers pose a threat to other species, particularly the threatened spectacled (*Somateria fischeri*) and Steller's eiders.

<u>*Objectives*</u> The objective of this study is to document summer foraging ecology, and distribution and abundance of ravens nesting within areas of oil development, in and near villages, and in semi-natural habitat (DEW Line sites) on Alaska's North Slope.

Methods

1. Use biological surveys and obtain anecdotal information from local residents to document the distribution and abundance of ravens breeding in the oil fields, in and near villages, and in semi-natural sites using surveys and local knowledge. A GIS map will be produced showing the locations of nests and/or breeding pairs.
2. Document the summer diet of nestling ravens using video camera monitoring stations, by direct observation at nests, by examination of pellets and/or fecal remains, and by collection of prey remains at nests.
3 Monitor nests to assess fledging and nest success of ravens in and outside of the oil fields.
4. Use VHF and satellite telemetry to document the movements of ravens from nesting sites to foraging areas, and between breeding and non-breeding seasons on Alaska's North Slope.

Date Information Required: A final report is due July 2006.

Revised date: September 2005

Region: Alaska

Planning Area: Beaufort Sea

Title: Pre-migratory Movements and Physiology of Shorebirds Staging on Beaufort Sea Littoral Zone

MMS Information Needs to be Addressed: MMS will use results on shorebird distribution and abundance from this study, and related studies cited within, to estimate the effects of various oil spill scenarios on the Beaufort Sea breeding and staging shorebird population. MMS will also use information on habitat-use, and peaks in staging and turn-over times to improve NEPA assessments of potential impacts of oil development, and potentially to develop mitigation measures for future OCS activity, and supporting onshore development. This work will compliment other ongoing research on tundra breeding shorebirds, and allow a more complete evaluation of the potential effects of oil and gas development. MMS will utilize information obtained from this study for NEPA analysis and documentation for Beaufort Sea Lease Sales, post-sale mitigation, exploration plan reviews, and DPP's.

Actual Costs (in thousands)**:** **Period of Performance:** FY 2004-2007
FY 2004: $124
Total Cost: $124

Conducting Organization: CMI, UAF

Description:
Background Preliminary work conducted during the 1970's near Barrow, Alaska, indicated that shorebirds breeding along Alaska's North Slope use the Beaufort Sea littoral zone extensively for nutrient acquisition prior to migration to wintering areas in Asia and the Americas. However, little information exists on the seasonal distribution and abundance of pre-migratory shorebirds that use littoral zones along the entire Beaufort Sea and what factors may influence the duration and timing of use. This information is important given increased interest in oil and gas exploration and other development across the Arctic coastal plain. Shorebirds are granted protection under the Migratory Bird Treaty Act, and several species that breed and stage along the Beaufort Sea (Dunlin, American Golden-plover, Bar-tailed Godwit, and Whimbrel) appear on the USFWS list of birds of conservation concern. A better understanding of the ecology of staging shorebirds across the Beaufort Sea littoral zone could be useful for assessment of potential effects from current and future industrial activity, including possible contamination of brooding and staging habitats from oil or gas spills, human disturbance, or increased rates of predation by species (e.g., gulls and ravens) whose populations have increased through anthropogenic changes in the area.

Objectives

1. Assess the species composition, distribution, abundance, and habitat use of pre-migratory shorebirds staging along Beaufort Sea coastline.
2. Examine factors affecting shorebird use of littoral zones near Barrow, Alaska, as a reference site for the remaining portions of the Beaufort Sea coastline.

Methods

1. Conduct a single aerial survey for staging shorebirds along the Beaufort coast from Point Lay to Demarcation Point on the Canadian border during August and September 2005 and 2006. Four teams of biologists will be stationed on the ground along the aerial flight line to identify species using the area and correct aerial survey data.
2. Locate and monitor littoral transects around Barrow to determine species-specific habitat preference, turnover times, and movements between local staging sites.
3. Mist-net and blood-sample birds at littoral staging sites in the Barrow vicinity to examine differences in fattening rates (measured by plasma fat metabolite levels) and physiological stress levels (measured by blood corticosterone concentrations). This information will provide information about the physiological mechanism behind the timing and duration of pre-migratory shorebird use of Beaufort Sea littoral zones.

Date Information Required: A final report is due July 2007.

Revised date: September 2005

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDIES PLAN 2006

Region: Alaska

Planning Areas: Beaufort Sea

Title: Modeling Recovery Rates for Avian Populations

MMS Information Needs to be Addressed: The MMS NEPA analyses will benefit substantially from the addition of more accurate determinations of recovery rates following assumed losses from populations of species for which there is concern over the status and trend, or those listed under ESA. Information provided in this study would respond to concerns expressed by FWS and environmental organization reviews of Northstar and NPR-A. Information will be used for NEPA analysis and documentation for Beaufort Sea Lease Sales and DPP's.

Estimated Costs (in thousands): **Period of Performance:** FY 2001-2006
FY 2001 $125 (BRD)
FY 2002 $125 (BRD)
Total Cost: $250 (BRD)

Conducting Organization: USGS BRD

Description:
Background At least ten avian species, principally loons, waterfowl and shorebirds are found in the Beaufort Sea region and may be at potential risk of effects of oil and gas development on the Alaska OCS. Several species are listed under the Endangered Species Act (ESA) or have experienced unusual declines in recent decades. MMS documents have included estimates of the time needed for avian populations to recover to their original level if affected by an oil spill or other mortality event, but such estimates are relatively subjective. It is important that MMS use statistically improved estimates of the potential for population recovery from possible mortality events. Species with highest priority for model development would be spectacled eider (model available), oldsquaw, common eider, king eider, yellow-billed loon, brant (model forthcoming), Steller's eider, Pacific and red-throated loons, and red-necked phalarope. Lower priority species in areas where oil and gas development may occur in the future include common and thick-billed murres, black-legged kittiwake, marbled murrelet, and wintering Steller's eiders. Data for various demographic parameters for some species currently need to be supplemented

Objectives The goal of this study is to hold a workshop in order to facilitate the development of a computer model, or models, which will estimate the time required for populations of avian species occupying the Alaska OCS to recover from certain levels of mortality caused by contact with an oil spill, or other perturbation. This effort would require accomplishing the following objectives:

1. Develop a model, or if necessary models, incorporating all variables and parameters required to yield realistic and accurate estimates of the time needed for each population experiencing various one-time mortality losses to recover to its initial level.
2. Develop the model(s) into a stand-alone interactive program with the capability to generate recovery rates associated with user-specified values for variables and parameters.

Methods A spectacled eider model of the type required by MMS has been developed recently; this can provide a basis for modeling other seaducks, and together with other existing models, it can be a starting point for modeling other species groups. Values necessary to model recovery rates for these species will require using appropriate values for such parameters taken from the literature. The MMS-sponsored Beaufort Sea waterfowl monitoring study (summer 1999) fills in some of the data gaps for oldsquaw and eiders. The recovery model, or models, will be produced during a workshop entitled: "Beaufort Waterfowl Recovery Modeling Workshop." Workshop participants will be of limited number, consisting mostly of experienced population modelers selected from all sectors, including governmental, academic and private. All available data for use in recovery modeling would be obtained, formatted and provided to participants well in advance of the workshop.

Date Information Required: A final model and report are due December 2005.

Revised date: September 2005

Region: Alaska

Planning Areas: Beaufort Sea

Title: Role of Grazers on the Recolonization of Hard-Bottom Communities in the Alaskan Beaufort

MMS Information Needs to be Addressed: This research is expected to lead to a better understanding of marine environments affected or potentially affected by OCS oil and gas exploration and development. Experimental studies to be conducted by the investigator could lead to a better understanding of natural environmental processes and possible influences of OCS activities. Information will be used for NEPA analysis and documentation for Beaufort Sea Lease Sales and DPP's.

Actual Costs (in thousands): **Period of Performance:** FY 2002-2006
FY 2002 $249
Total Cost: $249

Conducting Organization: CMI, UAF

Description:
Background In 1971, a diverse kelp and invertebrate community was discovered near Prudhoe Bay in Stefansson Sound, Alaska. This area has been named the Boulder Patch by the U. S. Board of Geographic Names. The Boulder Patch contains large numbers of cobbles and boulders that provide a substrate for attachment for a diverse assortment of invertebrates and several species of red and brown algae. The invertebrate assemblage that lives on the rocks and within the kelp beds has representatives from every major taxonomic phylum, according to a 1985 study. The predominant algae is brown, *Laminaria solidungula*, which constitutes 90% of the brown algal biomass. This alga is an important food source to many benthic and epibenthic organisms. Differences in infaunal abundance and biomass between the Boulder Patch and peripheral sediment areas demonstrate the importance of this unique habitat. In the Boulder Patch, algae and epilithic invertebrates cover nearly all exposed substrate, with the exception of recently upturned rocks, according to a 2000 study.

The Boulder Patch is potentially vulnerable to disturbance by oil and gas related activities. Construction of artificial islands and related trenching for construction of buried pipelines, such as is the case for the Northstar and proposed Liberty developments, can cause destruction of flora and fauna due to mechanical disturbance or sedimentation during construction. Other factors such as pollution could also have a detrimental effect. Recolonization experiments in the Boulder Patch have shown that recovery of denuded areas is slow, and one of the primary reasons for this may be grazing by invertebrates, according to a 1982 study. This study will employ various comparisons

using exclusion cages, cage controls and natural rock to assess the effect of grazing/predation on the rate of recovery of disturbed substrates in the Boulder Patch.

Objective Evaluate whether grazing is limiting the rate of recruitment of hard substrate communities in the Boulder Patch.

Methods

1. The study will be conducted at Dive Site 11 in Stefansson Sound, Alaska by teams of SCUBA divers.
2. Simple manipulations will be conducted to compare bare rock to bare rocks with exclusion cages. Necessary controls will be employed to evaluate factors such as light intensity and sedimentation.
3. Repeated measures analysis of variance will be used to analyze data collected for each group of organisms studied (red algae, brown algae, hydroids, bryozoans, tubeworms, and total cover).

Date Information Required: A final report is due December 2005.

Revised date: September 2005

Region: Alaska

Planning Areas: Beaufort Sea, Chukchi Sea,

Title: Susceptibility of Sea Ice Biota to Disturbance in the Shallow Beaufort Sea. Phase 1: Biological Coupling of Sea Ice with the Pelagic and Benthic Realms

MMS Information Needs to be Addressed: The information will be used by MMS to evaluate potential impacts from disturbances to the sediment by exploration and production of OCS resources. The information can help evaluate sensitive areas and appropriate mitigation measures. Information will be used for NEPA analysis and documentation for Beaufort Sea Lease Sales and DPP's

Actual Costs (in thousands): **Period of Performance:** FY 2002-2006
FY 2002 $193
Total Cost: $193

Conducting Organization: CMI, UAF

Description:
<u>*Background*</u> Sea Ice is a key component in structuring polar environments. Beside its important role as a platform for marine mammals and birds, it serves as a habitat for a unique highly specialized community of bacteria, algae, protozoa and metazoan which contribute to the biogeochemical cycles of the Arctic and Antarctic seas. Early seal hunters had already discovered the close relation between ice algae production and higher trophic levels when they found numerous seals associated with brownish-colored ice floes which they named seal-ice. This coloration is caused by billions of unicellular algae living within the sea ice. The ice algal primary production in seasonally ice-covered waters contributed 4-26% to total primary production and may contribute above 50% in the permanently ice-covered central Arctic. The enormous sediment load of so-called 'dirty ice' is assumed to have a profound impact on the ice biota but this impact has not been quantified yet. The only available estimate of annual ice algal primary production for the shallow Beaufort Sea report 5g Cm^{-2}. The general scarcity of ice algae biomass data highlights the need for comparative and supplementary new data on ice algal biomass in the Beaufort Sea.

Sea ice algae not only contribute significantly to the overall primary production of the Arctic, but also form the basis for the sea-ice related food web which extends to higher trophic levels such as sea floor dwellers, seals, and polar bears. Previous studies in the shallow coastal Beaufort Sea suggest that larvae of benthic copepods, polychaetes and gastropods use sea ice as a nursery ground whereas the adults of these taxa inhabit the benthos. Disturbance of the sea ice habitat, e.g. by enhanced sediment load, construction

of ice roads, and gas or oil spills, would likely impact the biological links between the ice, water column and sea floor.

Objectives Evaluate whether:

1. Sea ice biota contributes significantly to the biogeochemical cycle in the fast-ice covered shallow Beaufort Sea in terms of primary and secondary production and also as a seasonal habitat and food source for pelagic and benthic invertebrates.
2. Certain live stages of a number of benthic taxa depend on the ice algal biomass as a food source early in the year prior to the occurrence of phytoplankton blooms.
3. Disturbances of the linkages between sea ice, water column and benthos, e.g. by increased sediment load and changes in light availability, will reduce the abundance and survival of ice associated biota. This would affect the available amount of food to higher trophic levels such as fish, seals, and birds.
4. Abundance ratios of disturbance-sensitive to disturbance-insensitive taxa in sea ice can be used as a measure of pollution/disturbance of the area.

Methods

1. Conduct sampling on the floating fast ice close to Barrow at a water depth of 5-10 meters in early winter, early spring and early summer to cover an entire seasonal sea ice cycle.
2. Select sites to represent clear ice and dirty ice sediment loads to compare the impact of light availability on the biological activity in the ice.
3. Collect fast ice samples with a 10 cm ice corer.
4. Analyze lowermost 10 cm in 10-1, 1-5 and 5-10 cm segments by melting, filtering, extraction with acetone, and reading in a fluorometer.
5. Estimate light intensity under the ice with a light sensor and data logger.
6. Use dry weight of a second core to calculate the total amount of particulate matter in the ice.
7. Fix a sub-sample of melt for determination of ice algal, meiofaunal, and macro-faunal abundances.
8. Sample phyto- and zooplankton with plankton nets at intermediate water depths.
9. Sample benthic macrofauna with Van-veen grab in four replicates.
10. Assess rote of sea ice-produced particulate matter for the nutrition of sea ice meiofauna using isotopic signatures of zooplankton and zoobenthos.

Date Information Required: A final report is due December 2005.

Revised date: September 2005

Region: Alaska

Planning Areas: Beaufort Sea, Chukchi Sea, Hope Basin, Cook Inlet

Title: Review and Monitoring Ambient Artificial Light Intensity in the OCS and the Potential for Effects on Resident Fauna

MMS Information Needs to be Addressed: Information from this study will be used for evaluating the effects of exploration and development on various protected or endangered species, including: spectacled eider, Steller's eider, Bowhead whale, Beluga whale, polar bears, ringed-seals, and several other cetaceans and pinnipeds. If ambient light is found to have effects on these, or other, local fauna, mitigation measures can be designed and initiated through stipulations in future development- or production-oriented EIS's or permits. Information from this study may be used to update the extant lighting protocols recommended for offshore oil and gas development.

Actual Costs (in thousands): **Period of Performance:** FY 2004-2007
FY 2004: In procurement, TBD

Description:

Background Stipulation No. 8 of the MMS Final Beaufort Sea Multi-sale EIS (February 2003) requires that all structures associated with offshore drilling must be lighted in order to avoid avian mortality. But light radiating outward from structures must be minimized. Other industrial support facilities such as the buildings and storage areas at West Dock, structures at Endicott Spur Drilling Island, structures and work areas on Northstar Island and support vessels and supporting facilities are already brightly lighted. More lighted structures can be expected as OCS development proceeds.

Little study has been made of the introduction of artificial light into the formerly dark habitat of numerous species of marine invertebrates, fish, water birds, and mammals. These include a number of protected marine mammals that live in, or migrate through, potentially artificially lighted habitat. At a recent interagency coordination meeting the issue of potential conflict between lighting strategies and other non-avian marine life was raised. The proposed study will address the issue of artificial light in the dark arctic by conducting a literature review and possibly thereafter a light monitoring program. The study will lay groundwork for studies of ecological effects of increasing artificial lighting at several trophic levels.

Objectives

1. Review the literature and evaluate the theoretical basis of artificial lighting effects on the physiology, reproductive biology and/or behavior of key predators and their forage species in the Beaufort Sea area.

2. Plan and/or initiate long-term, meso-scale monitoring to measure and document general levels of ambient light in the Beaufort Sea OCS: (a) Design appropriate sampling methods and regime and (b) measure and document light in specific OCS development areas at various distances from sources, including new sources as they are created.
3. Initiate relevant ecological studies of Arctic marine systems in the vicinity of artificial light sources to estimate any effects of artificial light on the system's trophic processes, and productivity, and behaviors.

Methods All activities will be coordinated with ongoing industry studies as appropriate.

Phase I:
1. Conduct a comprehensive literature review. Prepare an annotated bibliography and summary report on the potential effects of artificial ambient lighting on relevant taxa.
2. Hold a facilitated scientific meeting to make recommendations on the justification for, and design of, a monitoring program. Recommendations for specific studies, defined under Objective 3, will also be recorded.

Phase II:
1. If justified, initiate a meso-scale monitoring study to document the intensity of artificial ambient lighting as per Objective 2, above.
2. Refine design and initiate focused ecological studies, as per Objective 3.

Date Information Required: A final report is due July 2007.

Revised date: September 2005

Region: Alaska

Planning Areas: Beaufort Sea, Chukchi Sea

Title: Monitoring the Distribution of Arctic Whales

MMS Information Needs to be Addressed: This continuing MMS study is needed for decisions on environmental assessment and exploration monitoring for past and upcoming OCS activity in the Beaufort Sea. It analyses behavioral information needed to identify areas of interest to feeding bowhead whales. In years with active offshore seismic-vessel or drilling operations, the BWASP provides real-time data to MMS and NMFS on each fall migration of bowhead whales across the Alaskan Beaufort Sea for implementing overall limitations on offshore drilling and geological and/or geophysical exploration. Project information is used to ensure that planned activities will not have an immitigable adverse effect on the availability of the bowhead whale to meet subsistence needs by causing whales to abandon or avoid hunting areas. Information is needed each year to monitor the migration of bowhead whales past active seismic, drilling, construction, and production operations. Information from this study also will be needed to support NEPA analysis and documentation for Beaufort Sea Lease Sales, DPP's, and monitoring of Northstar.

Actual Costs (in thousands):
FY2005 $450
FY2006 $475
FY2007 $500
Total Cost: $1,425

Period of Performance: FY 2005-2007

Conducting Organization: MMS

Description:
Background The MMS has conducted aerial surveys of the fall migration of bowhead whales each year since 1987. Methods are comparable from year to year, based on similar monitoring dating to 1979. Real-time data are used to implement overall seasonal restrictions and limitations on geological and geophysical exploration. The study provides the only long-term database for evaluating potential cumulative effects of oil- and gas-exploration activities on the entire bowhead-migration corridor across the Alaskan Beaufort Sea. Project reports compare distances from shore and the water depths used by migrating bowheads. Data are collected in a robust GIS-compatible data structure. The bowhead whale is protected under the Endangered Species Act and is of great importance to Alaskan Natives for cultural and subsistence purposes.

Objectives

1. Define the annual bowhead fall migration, significant inter-year differences, and long-term trends in distance from shore and water depth at which whales migrate.
2. Monitor temporal and spatial trends in the distribution, relative abundance, habitat, and behaviors (especially feeding) of endangered whales in arctic waters.
3. Provide real-time data to MMS and the National Marine Fisheries Service (NMFS) on the general progress of the fall migration of bowhead whales across the Alaskan Beaufort Sea for use in protection of this Endangered Species.
4. Provide an objective area-wide context for management interpretation of bowhead migrations and site-specific study results.

Methods Aerial surveys, based out of Deadhorse, Alaska, during September and October, monitor the fall bowhead migration between 140°W. and 157°W. longitudes, south of 72°N. latitude. Particular emphasis is placed on regional randomized transects, statistical tests, and power analyses to assess fine-scale shifts in the migration axis of bowhead whales across the Beaufort Sea, and on the coordination of effort and management of data necessary to support seasonal offshore-drilling regulations. The project analyzes migration timing, distribution, relative abundance, habitat associations, swim directions, water depths, and behaviors (especially potential feeding) of whales, as well as ice type and percentage at bowhead sightings. Belugas, gray whales, and polar bears are regularly recorded along with incidental sightings of other marine mammals. Data are also shared with site-specific studies to define bowhead responses to individual oil-industry activities. Incidental oceanographic observations are shared with the National Ice Center and National Weather Service to ground-truth satellite imagery.

Date Information Required: A final report is due annually.

Revised date: September 2005

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDIES PLAN 2006

Region: Alaska

Planning Area: Beaufort Sea, Chukchi Sea, Bering Sea

Title: Satellite Tracking of Bowhead Whales: Planning Phase

MMS Information Needs to be Addressed: The study will provide information that will aid in predicting the distribution of whales in the Alaskan Beaufort Sea during the open water season and facilitate better planning of OCS activities, lease sales, and better oil spill response precautions and planning. The project, if implemented in the field, will provide important information to other proposed projects researching bowhead whale feeding. Information will be used for NEPA analysis and documentation, ESA consultations and DPP's related to Beaufort Sea Lease Sales.

Actual Costs: (in thousands**)**
FY 2004 $23
Total Cost: $23

Period of Performance: FY 2004–2006

Conducting Organization: CMI, UAF

Description:

Background Bowhead whales (*Balaena mysticetus*) are the most important subsistence species for communities along the Beaufort Sea coast both for nutritional value and for cultural importance. Bowheads migrate across the Alaskan Beaufort Sea during their eastward spring migration and their westward fall migration. Subsistence whaling communities are concerned that whales may avoid offshore and nearshore oil and gas, making hunting more difficult or affecting whale feeding. However, although the western Canadian Beaufort Sea and Amundsen Gulf areas are generally thought to be important summer feeding areas for bowhead whales, there is less agreement about the relative importance of feeding observed in the Alaskan Beaufort Sea. Oil spills during whale migrations are also of concern. Thus, an improved understanding of bowhead migration and feeding behavior in the Alaskan Beaufort area is important for planning of lease sale areas, permitting of other development-related activities, and designing mitigation.

Objectives

1. Design a study using satellite telemetry as a tool to answer questions regarding bowhead migration routes, migration timing, swim speed, diving behavior, residence times in portions of their range, and incidental exposure to industry activity, that does not interfere with subsistence whaling activities.
2. Encourage collaboration among whaling captains, AEWC, NSB, ADF&G, NMFS, MMS and other interested parties. This collaboration will enhance input into the study design and assess local involvement in tagging.

Methods

1. Communicate with whaling captains in Kaktovik, Nuiqsuit, and Barrow, the AEWC and other interested parties, to determine levels of interest in the proposed study.
2. Depending on interest, hold a workshop in Barrow with participants to include whaling captains, AEWC, NSB, State of AK, NMFS, MMS and other interested parties.
3. At the workshop, reach consensus on priorities of questions to be answered using satellite telemetry.
4. At the workshop, determine how best to coordinate and exchange information with other concurrent studies supported by MMS.
5. Evaluate satellite tagging technology, including equipment, deployment and attachment methods and make recommendations for proposed study.
6. Considering the above, prepare an implementation plan to seek funding for satellite tagging and data collection. Explore joint funding opportunities.

Date Information Required: An implementation plan is due December 2005.

Revised Date: September 2005

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDIES PLAN FY 2006

Region: Alaska

Planning Areas: Beaufort Sea, Chukchi Sea, Bering Sea

Title: Bowhead Whale Feeding Variability in the Western Alaskan Beaufort Sea

MMS Information Needs to be Addressed: With additional information on the importance of the study area to feeding bowhead whales, and a better understanding of potentially predictable factors that correlate with variations in whale behavior, alternative mitigation options for future Beaufort Sea lease sales may be feasible. Also this study addresses a Conservation Recommendation in NMFS' 2001 Arctic Region Biological Opinion that MMS study "the use of the Beaufort Sea by feeding bowheads and assess the importance of this feeding to the health and well being of these animals." Information from this study will be used for permit approvals for all Beaufort Sea Lease Sales and NEPA analysis and documentation for Beaufort Sea Lease Sales and DPP's.

Actual Costs (in thousands) **Period of Performance:** FY 2005-2011

FY 2005: In procurement, TBD

Description:

Background A previous MMS study estimated the extent to which the bowhead whale population utilizes OCS areas in the eastern Alaskan Beaufort Sea for feeding, as well as that area's importance to individual whales. Additional research on this subject has been requested particularly at locations other than those included in the previous study. In a 2001 Arctic Region Biological Opinion NMFS made a Conservation Recommendation that MMS continue to study "the use of the Beaufort Sea by feeding bowheads and assess the importance of this feeding to the health and well being of these animals." Other stakeholders have recommended that MMS expand the scope of the research to include the entire Alaskan Beaufort Sea.

In this proposed study, emphasis will be placed on achieving an understanding of the factors enhancing or limiting the expression of feeding behavior in various locations in the western Alaskan Beaufort Sea. Implicit to the proposed study is the assumption that feeding by bowhead whales occurs with some degree of regularity during August-October the western Beaufort Sea study area. It is further assumed that variation in feeding behavior potentially results from any, or all, of a variety of environmental and behavioral variables including, but not limited to: sea ice coverage, oceanographic conditions, prey concentrations, and movements by whales, potentially from summering areas in both the Beaufort Sea and Chukchi Sea. By understanding how such factors are related to bowhead feeding in western Beaufort Sea locations near offshore oil and gas leases, MMS would be in a better position to mitigate potential effects of such actions on bowheads and their populations.

Objectives To better understand the relationship between feeding and environmental and behavioral variables on the timing and spatial extent of bowhead feeding in the western Alaska Beaufort Sea; specifically to:

1. Document the movements of whales of various ages, sexes, and reproductive statuses from the Beaufort Sea and Chukchi Sea within, into and out of the study area.
2. Document feeding behavior and prey utilization by bowheads at locations in the western Alaska Beaufort Sea with emphasis on timing and dynamics/variability.
3. Document variability in locations and densities of potential prey of bowhead whales.
4. Estimate variability of physical oceanographic conditions associated with concentrations of bowheads and their prey.
5. Integrate results from this study with previous results from other sources to develop a dynamic model of bowhead feeding behavior in the western Alaska Beaufort Sea.
6. Synthesize existing results and conclusions in a scientifically reviewed monograph to be published in an appropriate journal or other similar outlet.

Methods This study will have two phases and be conducted over geographic and temporal scales sufficient to include normal variability associated with environmental phenomena including local currents and upwellings, variation in ice conditions, and *el Nino*. The study area will be encompassed by the polygon bounded by the shoreline, 100 m isobath, 152^{o} W and 155^{o} W meridians.

Phase I: A task employing satellite transmitters would be designed and conducted to provide information on topics including, but not limited to: bowhead movements in and out of the study location, migration timing, swim speed, and residence times in functionally important portions of bowhead whale range. Collaborations would be developed between whaling captains, AEWC, NSB, ADF&G, NMFS, MMS and other interested parties to resolve roles in permitting, co-sponsorship and implementation. Satellite transmitters would be deployed on bowhead whales near Native villages in the Beaufort, Chukchi and Bering Seas during spring and fall migrations. Transmissions would be monitored and data analyzed.

Phase II: Based on preliminary observations of locations of bowhead feeding having high potential for more comprehensive study and analysis as determined during Phase I, other project planning and research would be initiated in Phase II using planning and field methods similar to those of the previous eastern Alaskan Beaufort Sea bowhead feeding study. These would include planning meetings and fieldwork such as analyses of stomach contents at Barrow and Cross Island, behavioral observations by aircraft, plankton tows by small vessel, stable isotope ratios in baleen layers, fatty acid comparisons, recording of traditional knowledge, and computer modeling of feeding information. Real-time distribution of whales in the Beaufort Sea, as well as historic information on bowhead whale feeding activity in the study area, would be provided by the ongoing MMS *Bowhead Whale Aerial Survey Project*. The study would be carefully coordinated with the AEWC and Whaling Captains Associations in Barrow, Nuiqsut and Kaktovik to avoid interference with fall subsistence hunts and, where feasible, to involve whaling communities in the conduct of the study. Phase II would also involve the

concurrent and coordinated use of a combination of remote sensing and field measurement of oceanographic conditions in the study area.

Date Information Required: Information from this study will be used in NEPA analysis and documentation for Beaufort Sea Lease Sales, EP's, and DPP's. Annual reports are due in December 2006, 2007, 2008, 2009 and 2010. A draft and final report are due in October and December 2011, respectively.

Revised date: September 2005

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Region: Alaska

Planning Area: Beaufort Sea

Title: Aerial Photography of Bowhead Whales to Estimate the Size of the Bering-Chukchi-Beaufort Population

MMS Information Needs to be Addressed: Information from the study will be used for ESA and NEPA analysis and documentation for Beaufort Sea Lease Sales and DPP's.

Actual Costs (in thousands): **Period of Performance:** FY 2004-2006
FY 2004 $70
Total Cost: $70

Conducting Organization: NMFS/NSB

Description:
Background An aerial photographic survey of bowhead whales was conducted during the spring of 2003 based out of Barrow, Alaska. This survey was very successful with >750 photographs having been obtained. Analysis of the photographs is expected to be useful toward an improved population size estimate using mark and recapture methods. This project is envisioned as a jointly funded effort, including but not limited to NMFS, NSB, and MMS. Additional funding sources may be involved as needed to seek additional population dynamics information.

Biological information about the status of endangered bowhead whale stocks is useful for OCS management and to maintenance of the centuries-old subsistence lifestyle along the north coast of Alaska. Two of the most important statistics are current population size and population trends. Population estimates are typically generated via ice-based censuses at Barrow; however, few (if any) data exist to confirm the apparent population increases indicated by these counts. Credible confirmation of population size would help evaluate whether the Bering-Chukchi-Beaufort bowhead whale population should be down-listed to the threatened species list. Other life history parameters (migration timing, etc) obtained from the study would likewise be useful for management of offshore activities.

Objectives The primary goal of the survey is to estimate the size of the bowhead whale population using photogrammetric mark-recapture methods and data collected during 2003 and 2004. Specific objectives for accomplishing this goal include:

1. Conduct an aerial photographic survey of bowhead whales in the spring of 2004.
2. Analyze the 2004 photographs to identify the recurrence of individual whales previously photographed in 2003.
3. Use mark-recapture methods and calculations to estimate the population of bowhead

whales.

Methods This jointly-funded study would be conducted using methods already developed in 2003 by NMFS and NSB. Required permits for low-level photography will be obtained as needed. The draft final report to MMS would include full description of the aerial survey protocol, mark-recapture methods used, analysis of collected data, and discussion of findings relative to population estimation. Other ancillary population dynamics parameters obtained on growth rates, survival rates, migration timing, calving intervals and population structure (length-frequency distribution) may be included.

Date Information Required: A final report is due August 2006.

Revised date: September 2005

Region: Alaska

Planning Area: Beaufort Sea

Title: Analysis of Covariance of Human Activities and Sea Ice in Relation to Fall Migrations of Bowhead Whales

MMS Information Needs to be Addressed: Information from the study will be valuable to the consultative process under the existing stipulation on subsistence whaling and other subsistence activities (Stipulation No. 5). It addresses long-standing concerns about oil-industry activity raised by subsistence whale hunters and government agencies. Study information is needed for NEPA analysis and documentation for Beaufort Sea Lease Sales and DPP's.

Actual Costs (in thousands): **Period of Performance:** FY 2004-2006
FY 2002 $135
Total Cost: $135

Conducting Organization: LGL, Ltd.

Description:
Background Recommendations for this study were made at an MMS-sponsored arctic seismic synthesis and mitigating measures workshop held in Barrow in 1997. Comprehensive analysis of the potential effects on bowhead whales of oil-industry activities has been limited by the resolution of data available on these activities and by disparate survey methodologies used to obtain whale data. Quantitative data on historical human/industrial activities and sea ice in the Alaskan Beaufort Sea, for one period 1970-1995 are available in an MMS-sponsored study completed in 2002. This follow-on study will compare that information with available bowhead distributional and behavioral data. Specific hypotheses will be tested to estimate statistical significance of relationships of key variables.

Objectives The goal is to estimate the significance of hypothesized relationships of previous oil-industry activity and sea ice on the Beaufort Sea distribution and behaviors of bowhead whales. Specific objectives are to:

1. Assess the comparability of bowhead whale data collected by site-specific and broad-area surveys and the feasibility of pooling these data to detect whale distributional shifts or behavioral changes up to 40 miles from noise sources.
2. Obtain from available information appropriate measures of sea ice for covariant analysis with whale distribution data.
3. Present preliminary tests and findings, define biases and assumptions, and recommend appropriate statistical procedures (e.g., analysis of covariance, regression techniques, K-S tests, spatial analysis, computer modeling.

4. Apply applicable procedures to test hypotheses on relationships of the timing, location, and activity status of oil-industry/human activity and the distribution and behavior of bowhead whales (1979-1998).

Methods

1. Utilize existing data in the recently developed MMS database for Beaufort Sea human activity and data in the MMS Bowhead Whale Aerial Survey Project database.
2. Consider positions and daily activity status of each drilling platform, helicopter, icebreaker, and other support vessels.
3. Adopt similar measures between years to facilitate inter-year comparisons and trend analysis.
4. Control for presence of commercial vessels, subsistence hunting, and low-flying aircraft.
5. Evaluate site-specific and wide-area data from MMS- and oil-industry-funded surveys of the fall distribution of bowhead whales (1979-1998) for applicability and pooled analysis.
6. Using appropriate inferential statistical procedures, test hypotheses for significant relationships of human activities and bowhead distribution and evaluate power of tests.
7. Produce a final report suitable for a wide audience, including North Slope subsistence whaling villages.

Date Information Required: A final report is due December 2005.

Revised date: September 2005

Region: Alaska

Planning Areas: Beaufort Sea

Title: Protocol to Deflect Migrating Bowhead Whales Away from an Oil Spill

MMS Information Needs to be Addressed: In a 2001 Arctic Region Biological Opinion, National Marine Fisheries Service provided a Conservation Recommendation that MMS study "the possible use of air guns as a deterrent for bowhead whales near an oil spill." A protocol for keeping bowheads away from oil spills would likely become a key part of any first-line response in the unlikely event of a large oil spill in the Beaufort Sea. The protocol would help reduce the potential for any oil-spill-related mortality or sublethal effects (e.g., feeding and reproduction) to this endangered species. While implementing the protocol might add to the expected disruption of the whale harvest in the year of any large oil spill, it would reduce the likelihood and scope of potential damage relative to perceived tainting of muktuk and other tissues. The protocol may be used to update the technical manuals relative to oil-spill preparedness at Northstar. The information is also applicable to oil-spill preparedness at Liberty, if needed.

Actual Costs (in thousands): **Period of Performance:** FY 2003-2006
FY 2003: $237
Total Costs: $237

Conducting Organization: LGL, Ltd., Environmental Research Associates

Description:
Background As a member of the North Slope Spill Response Project Team, MMS utilizes the Alaska Clean Seas (ACS) Technical Manual in the unlikely event of a large oil spill in the Beaufort Sea. In addition, oil companies submit an Oil Prevention and Technical Plan (OPTP) to MMS for Federal approval. While these plans consider deflection of polar bears and waterfowl, neither the ACS Technical Manual nor the OPTP deal specifically with bowhead whales, an endangered species and a most important species to North Slope subsistence villages. The study would test methods and develop a step-down protocol for on-scene managers to rapidly mitigate the effects of a large oil spill on bowhead whales.

Objectives The overall goal of the study is to develop guidelines for keeping bowhead whales away from large oil spills. Specific objectives for meeting this goal are to:

1. Analyze the literature on potential methods (e.g., noise) for herding or deflecting cetaceans away from oil spills or other effects.

2. Develop a workable field protocol for using tested methods to keep bowhead whales

away from a large oil spill.

3. If necessary and feasible, conduct selected field tests to evaluate the most effective ways to deflect captive cetaceans and/or bowhead whales away from a proscribed area.

Methods Analysis of the literature will consider the potential for use of acoustic disturbance (e.g., seismic arrays, icebreaker cavitations, whale boats, orca noise), visual disturbance (e.g., low-flying aircraft), and physical barriers (e.g., oil booms, stationary nets. The protocol will have a rapid-deployment quality in the unlikely event of a large oil spill. The cost of implementing the protocol should be considered, but should not limit important workable options. The purpose of the protocol is to exclude or deflect migrating whales away from the perimeter of a large oil spill without scattering whales in adverse directions. Variables to consider that might limit the effectiveness of certain options include ambient ice type and ice concentration, competing disturbances from oil-spill cleanup activities, and uncontrolled vessel and air traffic.

Date Information Required: A final report is due December 2005.

Revised date: September 2005

Region: Alaska

Planning Areas: Beaufort Sea

Title: Demography and Behavior of Polar Bears Feeding on Stranded Marine Mammal Carcasses

MMS Information Needs to be Addressed: Oil and gas operations on the Coastal Plain of the Beaufort Sea are ongoing and may be expanding to additional offshore areas. Recent EIS's have highlighted the need for additional information on polar bear use of coastal habitats. Estimating the number, sex, and age class of polar bears using marine mammal carcasses will help managers document and evaluate the ecological significance of coastal areas to polar bears. Results from this study can also be used to implement measures that decrease impacts of human activities on polar bear feeding habitat and minimize human interactions with polar bears. Information from this study will be used for NEPA analysis and documentation for Beaufort Sea Lease Sales, post-sale mitigation, exploration plan reviews, and DPP's.

Actual Costs (in thousands): **Period of Performance:** FY 2002-2006
FY 2002 $217
Total Cost: $217

Conduction Organization: USFWS

Description:
Background: In the Beaufort Sea, polar bears make extensive movements between the United States and Canada. Alaskan polar bears spend most of the year on the drifting pack ice, but in late summer and fall, polar bears travel along the coast and barrier islands of Alaska and have been observed feeding on stranded marine mammal carcasses. In recent years large numbers of polar bears congregate at whale harvest sites near Kaktovik, Barrow, Cross Island, and barrier island complexes along the Beaufort Sea. In addition, an increase in polar bear numbers and a seasonally earlier and more protracted use of the Beaufort Sea coastline and barrier islands in Alaska have been noted in recent years.

Certain sex-age classes of polar bears may use beached marine mammal carcasses more frequently than other sex-age classes. Studies by Canadian scientists indicate that on sea ice, independent yearlings, subadults, and family groups may be displaced from their kills by larger, more dominant bears, according to a 1974 study. Stranded marine mammal carcasses may provide an important alternative food source to animals unable to compete with dominant male polar bears for their primary food source, ringed seals. Marine mammal carcasses may also be important during periods of a polar bear's life cycle when energetic demands are increased. Examples are females with increased energetic costs associated with milk production for cubs and younger bears with increased metabolic

needs associated with growth. Bears in these situations are more likely to become nutritionally stressed, according to a 1985 Study.

Recent estimates of potential mortality of polar bears due to oil spilled from OCS developments, as indicated in a recent MMS EIS, suggest that most mortality of bears due to spilled oil is likely to occur among bears concentrating on or near barrier islands. For the latter analysis, bears on islands were assumed to be exposed to spilled oil and thus, die. This assumption was applied because existing telemetry data are not sufficiently accurate to allow determination of how bears allocate time between terrestrial and open water habitat. However, bears remaining on land when oil is present are obviously at much lower risk than bears entering water. Estimates of bear mortality due to oil spills would be more realistic and have greater utility if they incorporated information on patterns of use of land versus water habitat (and associated risks) by bears forming the concentrations discussed above. This relationship is especially important since the most vulnerable class of bears is likely to be demographically important females.

No systematic observations have been conducted to quantify the level of use or potential importance of marine mammal carcasses to certain age and sex classes of polar bears. Little information is available to assess how bears consuming carcasses allocate time between land and water habitat. If such information were available it would be particularly useful for oil spill risk assessment. For example, if bears consuming carcasses tend to remain on land for extended periods (i.e. days) while alternating feeding and resting, and not enter adjacent water, they are likely to be at less risk to exposure to encroaching spilled oil than bears that frequently enter water.

Objectives: The purposes of this study are to identify the magnitude of interchange of bears to and from feeding sites, the sex/age composition, utilization patterns, and behaviors of polar bears using beach cast marine mammal carcasses along the Beaufort Sea coastline in Alaska.

Methods

1. Monitor polar bears feeding on the remains of hunter-harvested bowhead whale carcasses at Kaktovik and other locations along the Beaufort Sea coastline.
2. Conduct observations with binoculars and spotting scopes during daylight hours for up to 30 days to estimate the exchange rates, sex/age composition, activity budgets, habitat use, and behavior of bears at the feeding site.
3. Complement these observations by information on utilization patterns and demography obtained from various aerial surveys conducted by MMS and industry.

Date Information Required: A final report is due October 2005.

Revised date: September 2005

Region: Alaska

Planning Areas: Beaufort Sea, Chukchi Sea

Title: Populations and Sources of Recruitment in Polar Bears

MMS Information Needs to be Addressed: The study will enhance MMS analysis of oil-spill/polar bear mortality models and provide direct input to population-recovery models currently under development for the Alaskan Beaufort Sea Region. Study information will be used for NEPA analysis and documentation for Beaufort Sea Lease Sales. It will also contribute information used for mitigation related to Northstar, Liberty, if approved, and DPP's.

Actual Costs (in thousands) **Period of Performance:** FY 2005-2011
FY 2005: In procurement, TBD

Description:
Background The approximately 22,000-27,000 polar bears of the world are currently divided among 19 recognized "populations" circumscribing the Arctic Region of the Northern Hemisphere. Although these units are referred to as "populations" there is no genetic or behavioral basis for assuming genuine isolation. The designation of these geographic populations has been largely political, in conformance with management needs, even though the units are inadequate for evaluating population discreteness, for estimating recovery from perturbations, setting harvest goals, or accounting for gene flow. Polar bears are important for subsistence, are considered a high-profile species by the general public, are the focus of a rapidly developing ecotourism industry in several Arctic coastal villages, and may be affected by disturbance and spilled oil potentially associated with OCS oil-and-gas development. Long-term monitoring of juvenile-adult polar bears has not previously been accomplished and will greatly enhance understanding of basic biology and population demographics for this key age group and the population as a whole.

Past studies of individual polar bear movements suggest that adults occupy somewhat restricted home ranges; however data are generally restricted to females because it is difficult to fit adult males with transmitter collars. In any case, adult movements do not accurately represent population structure because natal dispersal is the dominant control against population isolation in most vertebrates, with male-biased natal dispersal dominant among mammals. Thus, data on the movements of juvenile polar bears, including their adult home-ranges, is the missing critical element.

One benefit of the study is to expand collaboration between local university/government researchers and subsistence hunters along the Canadian Beaufort Sea (and adjacent coastlines). Such collaboration will complement previous/ongoing studies conducted in the Alaskan Beaufort Sea Region, but will add fresh new insights because of the

emphasis on representative gene flow and dispersal. Approximately 200 polar bears are already expected to be captured in the Canadian Beaufort Region each year for the next 4 years. This study is timed to take advantage of considerable savings in logistics by partnering with that ongoing Canadian study.

Objectives The objective of this study is to provide data necessary for interpretation of the population structure of polar bears in North America. Emphasis will be placed on understanding the importance of natal dispersal in polar bears and, specifically, on the extent to which bears born in, or near, Canada make use of United States land, nearshore, or OCS habitats at various life stages

Methods

1. Develop a partnership between University and Canadian Government polar bear biologists, and Canadian Natives to implement a study of juvenile polar bears using long-lived satellite transmitters for monitoring.
2. Test and Deploy satellite transmitters with the capability to permit multi-year (3-5 year) monitoring of juvenile polar bears. Verify and test remote release mechanisms for collars.
3. Capture juvenile polar bears and deploy up to 15 such satellite transmitters per year for 3 years.
4. As possible, take blood and tissue specimens for archival at AMMTAP, for genetic analysis, and for contaminants analysis.
5. Evaluate current and potentially more ecologically rigorous population designations in light of data from this study and other sources.

Date Information Required: Annual reports are due July 2006, 2007, 2008, and 2009 and a stand-alone final report is due October 2010.

Revised date: September 2005

Region: Alaska

Planning Areas: Beaufort Sea, Chukchi Sea, Hope Basin

Title: Simulation Modeling of the Effects of Arctic Oil Spills on the Population Dynamics of Polar Bears

MMS Information Needs to be Addressed: Polar bears are known to be highly sensitive to direct oiling. Some subsistence hunters and environmental groups previously expressed opposition to lease sales that might adversely affect polar bears. The study will enhance MMS's ability to predict the effects of a potential oil spill in the Beaufort Sea on large concentrations of polar bears such as those that den on Wrangel Island or that congregate near bowhead whale carcasses. The study will be beneficial in implementing the existing stipulation on protection of biological resources. The study will develop information that addresses public concerns raised during previous outreach efforts. Study information will be used for NEPA analysis and documentation for Beaufort Sea Lease Sales.

Actual Costs (in thousands): **Period of Performance:** FY 1999-2006
FY1999 $150 (BRD)
Total Cost: $150 (BRD)

Conducting Organization: USGS Biological Resources Division

Description:
Background In order to predict the effects of oil spills on polar bears, data on oil spill trajectories must be married with data on polar bear distributions and abundance to yield hypothetical patterns of mortality. The long-term effect of the spill on the stability of bear populations can be predicted by applying a population recovery model to mortality data as derived above. A great deal is already known about the distribution and movements of mature female polar bears in Alaska OCS Beaufort Sea planning areas through an ongoing program of satellite tagging and tracking conducted by USGS-BRD. The USGS-BRD maintains a data set on polar bear distribution in Arctic waters. Information is also available on the potential effects of oil on individual polar bears. The MMS has an updateable arctic oil-spill trajectory model that is used each time there is a Beaufort Sea Environmental Impact Statement. The study is coordinated as appropriate with MMS oil-spill modelers.

Objectives The study design will link the efforts of BRD polar bear researchers and MMS oil spill modelers to predict the effects of hypothetical Beaufort Sea oil spills and other postulated mortality on the population recovery of polar bears. The study will develop computer program modules to this end. Specifically BRD researchers will:

1. Develop/refine an independent, conceptual, polar bear population-dynamics model

for Alaskan waters, with assumptions and initial conditions that can respond to hypothetical removals. Conduct a sensitivity analysis of this model.
2. Create a database on expected mortality of polar bears under various oil spill scenarios that can be interfaced with oil spill trajectory models.

Methods The study will develop a model of polar bear population dynamics and use it to simulate population-level recovery from hypothesized removals due to potential oil spills. The model will have mechanisms for linking it with the MMS Oil Spill Risk Analysis (OSRA) model trajectories for the Beaufort Sea. The final work product will include appropriate data bases, computer programs and existing algorithms on polar bear life history, population dynamics, and known seasonal distribution in Arctic waters, based primarily on existing satellite-tracking data on adult female polar bears collected by USGS-BRD. The study will model hypothesized mortality and population recovery of both Beaufort and Bering/Chukchi Sea populations of polar bears in response to Beaufort Sea oil spills and other postulated mortality. BRD scientists will prepare the interactive model, compatible with MMS hardware and software standards at the time of completion, and a user-friendly manual. They will manual demonstrate the model and manual to MMS biologists, varying data input and model assumptions as appropriate for future lease sales.

Date Information Needed: A final model is due December 2005.

Revised date: September 2005

Region: Alaska

Planning Area: Beaufort Sea

Title: Assessing Reproduction and Body Condition of the Ringed Seal (*Phoca hispida*) near Sachs Harbour, NT, through a Harvest-based Sampling Program

MMS Information Needs to be Addressed: This study will assist MMS in its responsibility for identifying and mitigating potential effects of OCS development on ringed seals and polar bears. Information gained will be relevant to the interpretation of results from a Canadian polar bear population assessment underway in the Beaufort Sea and various concurrent, MMS-funded marine mammal studies. The information will be used for NEPA analysis and documentation for Beaufort Sea Lease Sales and DPP's.

Actual Costs (in thousands) **Period of Performance:** FY2005-2010
FY 2005: In procurement, TBD

Description:
Background
Ringed seals are the most abundant pinniped in the Arctic Ocean and along the Alaskan Beaufort Sea coastline. Population stocks of the ringed seals have not been delineated but ringed seals are capable of having large home ranges, with some seals making long movements between wintering and summering habitats. For example, ringed seals tagged at Cape Parry, NT, Canada, in September of 2001 and 2002, were found to migrate westward along the Alaskan Beaufort Sea coastline and into the Chukchi Sea for over-wintering. Since ringed seals from the U. S. Beaufort and seals from Western Canada appear to intermix in the Beaufort and Chukchi Seas, and habitat is fairly similar along those respective coastlines, information from ringed seal studies in the Western Arctic of Canada is potentially useful for understanding the health status of ringed seals in Alaska, including those spending at least some of the year near the oil and gas developments along the shoreline of the Beaufort Sea and Beaufort OCS.

The health and condition of ringed seals in the Beaufort Sea are important to biologists, hunters and managers for several reasons. They have been proven to be useful indicators of the physical and biological environment. As ubiquitous and important prey, they are critical to the well being of polar bears. Also, they are valued as a subsistence resource by the Inupiat and the Inuvialuit. Changes in the seal population that have been documented in the western Arctic in the past, have included a reduction in ovulation rates among mature females, reduced percent pups in the harvest, reduced number of birth lairs, a possible shift in the age of sexual maturity, and changes in relative abundance during both ice-covered and open water periods. Moreover, changes in the reproduction and condition of ringed seals in the eastern Beaufort Sea can have profound effects on the polar bear population (see review in Stirling 2002). In particular, during years when the

ice conditions are particularly heavy, seal fatness, reproduction and pup survival have been observed to decline, resulting in a subsequent decline in reproduction of polar bears and survival of their cubs.

The purpose of this study is to cosponsor a sampling program jointly funded with the Department of Fisheries and Oceans (DFO), Northwest Territories, Canada and in cooperation with Inuvialuit subsistence hunters in the Sachs Harbor area. Data on seal body condition and reproductive output will provide an assessment of the status of the ringed seal population in relation to its environment and as a prey resource for Beaufort Sea polar bears.

Objectives

1. In coordination with ongoing seal monitoring studies in Holman and along the Alaskan Beaufort Sea coastline, to sample and measure ringed seals taken by Inuvialuit hunters in the Sachs Harbour area (minimum of n = 80).
2. Use reproductive status and body condition as indicators to evaluate ecosystem productivity and fluctuations in the seal population.
3. To contribute biological data on Beaufort Sea seal populations for use in interpretation of condition and reproduction rate data on polar bears collected in the same general study area through the same time period.
4. To examine these aspects in the context of annual variation in regional ice conditions.
5. To co-ordinate with, and provide samples for, "stock health" related studies, such as disease and contaminants.

Methods The proposed study will be coordinated by DFO (Stock Assessment Section), in collaboration with Resources, Wildlife and Economic Development (RWED) and the Canadian Wildlife Service (CWS). The project will utilize the same methods as an ongoing project in Holman, NT, and collect data that are comparable to existing data sets for seals in this area (CWS 1970's; FJMC 1987-1989, DFO 1992). Further information on this and other Canadian Beaufort Sea ringed seal studies is available at www.beaufortseals.com. Body condition of ringed seals harvested by Inuvialuit hunters near Sachs Harbour, and two parameters of seal reproduction (ovulation rate and percent pups in the harvest) will be analyzed. These parameters were selected because (1) they varied with changes in the seal population during work in this same area in the 1970's and 1990's, so that new data can be compared with results from past years and (2) it is possible and practical to monitor these aspects over several years through a harvest-based study in the community of Sachs Harbour, NT

Date Information Required: Annual reports are due in December 2006, 2007, 2008, and 2009. A draft and final report are due January and March 2010, respectively.

Revised date: September 2005

Region: Alaska

Planning Areas: Beaufort Sea, Chukchi Sea

Title: King and Common Eider Migrations Past Point Barrow

MMS Information Needs to be Addressed: MMS will use the data on king and common eider distribution and abundance from this study, and related studies mentioned above, to model the effect of various oil spill scenarios on the Beaufort Sea eider population. MMS will use information on basic natural history and ecology to improve assessments of potential impacts of oil development and, potentially, to develop mitigation measures for future OCS, and supporting onshore, development. MMS will use information from this study for NEPA analysis and documentation for Beaufort Sea Lease Sales, exploration plan reviews, and DPP's.

Actual Costs (in thousands): **Period of Performance:** FY 2002-2006

FY 2002	$196
FY 2003	$35
Total Cost:	$231

Conducting Organization: CMI, UAF

Description:

<u>Background</u> King (*Somateria spectabilis*) and common eiders (*S. mollissima v-nigra*) are an important resource for Native people in northern Alaska and Canada. Residents of Barrow harvest more king and common eiders than any other species of waterfowl (Fuller and George 1977). Most individuals of both species nesting in Alaska and Canada pass very close to shore at point Barrow, Alaska, twice annually – during their northward, spring migration and their southward, fall migration. Based on previous surveys conducted at Barrow from 1953 to the present, NSB scientists in 2000 argued that the king eider population appeared to have relatively constant numbers between 1953 and 1976, but may have declined by about 53% between 1976 and 1996. Those authors also argued that the common eider population may have declined by a similar magnitude (56%) during the same period.

Although eider surveys have been conducted periodically at Pt. Barrow since 1953, a comprehensive survey was last completed in 1996. This study will support a repeat of the previous surveys, using the same location, methods and some of the same observers that participated during 1996. This effort will expand the existing synthesis of eider migration data compiled in the earlier publication by NSB scientists in 2000 and should lead to a better understanding of the timing of migrations and use of the Alaskan Beaufort Sea OCS and coastal environments by the subject species. This study also is synergistic with three other ongoing MMS studies - two that address habitat use and movements of king eiders and a third that is developing recovery models for these and related species.

Objectives

1. Estimate the number of king and common eiders passing by Point Barrow in spring and fall 2003-2004 and compare with counts made in 1996.
2. Estimate the sex ratios of king and common eiders passing by Point Barrow in spring 2003 and 2004.
3. Estimate the timing and sex/age composition of king and common eiders leaving the Beaufort Sea in the summer of 2003 and 2004.
4. Investigate possible correlation among weather conditions and high passage rates of eiders within each migration.

Methods Investigators will follow the same methodology as was used in previous surveys at the same site.

1. Count eiders from the base of the Point Barrow spit between approximately 10 September and 30 October using one to three observers.
2. Make counts up to 10 hours each day in September, but limit to 2 hours per day by October as day length decreases.
3. Collect data on weather conditions (temperature, wind speed, wind direction, cloud cover, and visibility). For each flock sighted, record: time, direction of travel, species composition, number sighted, ratio of males to females for each species, and other comments on behavior.
4. Collect data from subsistence hunters regarding species, sex, and age composition, status of molt of late summer flocks.
5. Analyze data following previous methods in a study by NSB scientists in 2000.

Date Information Required: A final report is due April 2006.

Revised date: September 2005

Region: Alaska

Planning Areas: Beaufort Sea, Chukchi Sea

Title: Breeding Biology and Habitat Use of King Eiders on the Coastal Plain of Northern Alaska

MMS Information Needs to be Addressed: MMS will use results on king eider distribution and abundance from this study, and related studies mentioned above, to estimate the effect of various oil spill scenarios on the Beaufort Sea king eider population. Specifically, information from this study will be used in NEPA analysis and documentation for Beaufort Sea Lease Sales, post-sale mitigation, exploration plan reviews, and DPP's.

Actual Costs (in thousands): **Period of Performance:** FY 2002-2006
FY 2003 $105
Total Cost: $105

Conducting Organization: CMI, UAF

Description:
Background King eiders migrate across the OCS areas of the Chukchi and Beaufort Seas of Alaska. Migrations are characterized by large groups of birds that pass across the OCS areas in a restricted time and space. Thus, king eiders may be vulnerable to oil spills and possibly other oil and gas activities. King eiders are a species of special concern because the population using the Beaufort Sea appears to have declined by more than 50% between 1976 and 1996. The breeding biology of king eiders is not well known in either disturbed or undisturbed areas. There have been few studies dedicated to breeding biology of king eiders and most available information is anecdotal that was collected secondary to studies of other species or issues. Understanding the breeding biology of king eiders is important to better understanding and evaluating the causes for the possible population decline, specifically for evaluating any potential impact from oil and gas exploration or development. This study is related to and is synergistic with three other ongoing MMS studies: 1) a CMI study at Point Barrow that is a continuation of periodic counts of eiders migrating offshore the village; 2) a CMI study in which up to 60 king eiders are to be instrumented with implanted satellite transmitters and monitored during fall staging and migration, and spring migration; 3) a USGS BRD study in which recovery models are being developed for several species of water birds, including king eiders.

Objectives This study is designed to provide comparative data on the breeding biology and habitat use of king eiders nesting at an undisturbed site (Teshekpuk Lake) and a developed site (Kuparuk) on the Arctic Coastal Plain of Alaska.

Methods Observers will:

1. Search study areas in aircraft and on foot. Document distribution and abundance of king eiders and phenology of king eider nesting. Map nests and king eiders using GPS.
2. Record numbers of males, females and pairs daily to estimate arrival dates, departure dates of males, departure dates of failed or non-breeding females and females with broods.
3. Classify habitat associated with pre-nesting, nesting, brood-rearing, and post-nesting activities. Estimate land-cover status of nests for each nest using the BLM/Ducks Unlimited Landcover Inventory database for NPR-A, and established habitat classes.
4. Monitor nests to evaluate incubation patterns and hatching success. Download data using a remote cable to avoid flushing birds off nests. Estimate nest success using the Mayfield method as modified by Johnson. Monitor broods for as long as possible to estimate survival of the young.

Date Information Required: A final report is due December 2005.

Revised date: September 2005

Region: Alaska

Planning Areas: Cook Inlet, Beaufort Sea

Title: Biological Population Definition of Steller's Eiders Breeding in Alaska and Russia but Wintering in Cook Inlet

MMS Information Needs to be Addressed: This study will provide information critical to verifying assumptions and conditions of NEPA assessments and provide information needed to interpret the significance of any level of potential adverse effects on this species. Information is required to accurately assess risk to threatened STEI population and predict recovery from perturbations for pre- and sale NEPA and ESA analyses for proposed Cook Inlet Leases and proposed Beaufort Sea Lease Sales.

Actual Costs (in thousands) **Period of Performance:** FY 2005-2010
FY 2005: In procurement, TBD

Description:
<u>*Background*</u> Two distinct breeding populations of the Steller's eider (*Polysticta stelleri*, STEI) are recognized in the Chukchi-Bering-Pacific region, Alaskan and Russian Pacific. In 1997, the Alaska-breeding "population" of the STEI was listed as "Threatened" under the Endangered Species Act (ESA). The decision to list was based on the observed substantial decrease in the nesting range of STEI breeding in Alaska and the increased vulnerability of the remaining breeding "population" to extinction, accord to a 2002 USFWS Plan. In recent years, the number of STEI attempting to breed in Alaska has varied with breeding not occurring at many, or all, locations in any given year, according to a 2002 study. In a high year, a maximum of a few hundred STEI attempt to breed in Alaska, with nearly all nesting occurring near Barrow. In recent years STEI have only attempted to breed in about one out of three years near Barrow. This somewhat erratic breeding schedule has important implications to management.

A detailed population model has been developed to enhance understanding of STEI population dynamics and aid in identifying management options. These types of models build on our understanding of the species life history and utilize existing data to assess population dynamics, according to a 1998 study. However, two critical questions regarding STEI life history remain un-answered: (1) do individual females show breeding site fidelity to the Barrow area, and (2) do females attempt to breed elsewhere when not breeding near Barrow. Preliminary modeling suggests population dynamics are highly sensitive to females breeding elsewhere as opposed to skipping reproduction entirely in a given year. Further, models are only relevant to clearly defined populations. If females have low fidelity to a given breeding area, then local scale population models would be inappropriate. Genetic analyses have attempted to ascertain degree of site fidelity and population substructure of STEI across breeding areas. However, results to date are inconclusive. Thus, further interpretation of STEI genetic data and population dynamics requires additional information regarding life history characteristics.

Although STEI from Alaskan and Russian populations are indistinguishable visually, information from banding records and recent satellite telemetry studies indicates that during the autumn molt, winter, and spring staging periods individuals from the Alaskan population and the much more abundant Russian Pacific population intermix from southwestern to southcentral Alaska (including Cook Inlet). The relative contribution of these two breeding populations to molting, wintering, and staging groups in different areas is unknown. It is also not known whether, or to what extent, STEI from the Alaskan breeding population tend to aggregate in specific areas. As a result, untested assumptions currently underlie conclusions about the significance of potential adverse effects to the ESA-listed Alaska breeding population.

Objectives Analyze whether STEI breeding in Alaska and in the Russian Pacific are distinct biological populations.

Methods

Phase I: Convene a workshop inviting knowledgeable researchers and resource managers to discuss the state of knowledge of STEI population structure to recommend research and the design of studies (such as satellite tagging or genetics) that are necessary to achieve the objective. Produce workshop proceedings.

Phase II: Conduct research as recommended as a result of Phase I. Produce annual and final reports.

Date Information Required: Workshop proceedings for Phase I are due March 2008. For Phase II, annual reports for field seasons in 2007, 2008, and 2009 are due in March 2008, 2009, and 2010, respectively. Draft and final reports of Phase II are due July and October 2010, respectively.

Revised date: September 2005

Region: Alaska

Planning Areas: Beaufort Sea

Title: Population Structure of Common Eider Nesting on Coastal Barrier Islands Adjacent to Oil Facilities in the Beaufort Sea

MMS Information Needs to be Addressed: Information from this study will be used for NEPA analysis and documentation for Beaufort Sea Lease Sales and DPP's.

Actual Costs (in thousands): **Period of Performance:** FY 2002-2006
FY 2002 $138
Total Cost: $138

Conducting Organization: CMI, UAF

Description:
Background Surveys of sea ducks migrating past Point Barrow from 1953 to the present suggest that, although common eiders maintained relatively constant numbers between 1953 and 1976, they may have declined by about 56% between 1976 and 1996, according to a study by NSB scientists in 2000. While over 70,000 individuals were estimated to have passed Point Barrow on the 1996 spring migration, and over 111,000 on the fall migration, no total estimate has been given for the migration because no correction factor has been established for the proportion of birds migrating inland or offshore, beyond the field of vision of observers at the Pt. Barrow observation post. Of these migrating birds, a few thousand are believed to inhabit the coastline of the central Beaufort Sea, and typically about 500 pairs nest on barrier islands in that region each year.

Some wildlife managers have suggested that common eiders breeding on distinct islands, or island complexes, may be genetically distinct, and thus should be managed as separate units. If the posited population structure does exist, an accidental oil spill or disturbance from industrial development could destroy a common eider nesting colony (e.g., one nesting island) and it is possible that some unique genetic variant could be lost. In this study, investigators will use three classes of genetic markers that differ in their mode of inheritance to document the level of population structuring among common eiders breeding on coastal barrier islands of the central Beaufort Sea. Stock discreteness will also be evaluated on a broad scale for birds collected throughout Alaska and western Canada.

Objective To document population structuring among common eiders of the Pacific race at the macro- and micro-geographic levels.

Methods

1. Take tissue collections from common eiders nesting on barrier islands of the central Beaufort Sea for comparison with tissues available from the Yukon-Kuskokwim Delta, Aleutian Islands, and western Canada.
2. Assay and analyze autosomal and sex-linked microsatellite loci, and mitrochondrial and nuclear DNA sequences to evaluate genetic discreteness.

Date Information Required: A final report is due November 2005.

Revised date: September 2005

Region: Alaska

Planning Areas: Beaufort Sea

Title: Workshop and Field Evaluation of Bird Hazing/Deterrent Techniques

MMS Information Needs to be Addressed: The workshop will provide information to formulate procedures and protocols for a full study to test these technologies. These technologies could be used in oil spill response contingency planning to mitigate potential impacts to birds resulting from OCS activities in the Beaufort Sea. This information will be used for permit approvals after Beaufort Sea Lease Sales and DPP's.

Actual Costs (in thousands): **Period of Performance:** FY 2004-2006
FY 2004: $31

Conducting Organization: MBC Applied Environmental Sciences

Description:
Background Despite cleaning and rehabilitation efforts associated with oil spills, most oiled birds do not survive. Prevention of contact with spilled oil would avoid this mortality and the expense of operating an avian treatment facility that invariably is associated with a major oil spill. The Wildlife Protection Guidelines for Alaska within the State/Federal Unified Response Plan identifies hazing wildlife away from and deterring entry into a spill area as secondary response strategies for minimizing oil effects. Birds tend to avoid areas where disturbing human activities or devices producing loud sounds occur. These include aircraft and motorboat operations, and devices such as Breco buoy, wailer; 12-gauge cracker shell, and propane cannon. The latter devices, intended to haze birds away from a specific area, have been used in the field or undergone some evaluation for effectiveness. However, none of these have been rigorously tested under specific biological, oceanographic, or climatic conditions that would prevail if an oil spill occurred in the Beaufort Sea. Nor have studies focused on determining the effectiveness of a combination of hazing techniques in habitats similar to those in the Beaufort Sea. Field testing of hazing/deterrent devices and techniques to evaluate their effectiveness under Beaufort Sea conditions would aid in the development of oil spill response contingency planning in these areas. Because this involves a relatively unexplored area of investigation, field testing will be preceded by a workshop to evaluate available hazing/deterrent techniques and design a field research protocol to accomplish the field testing effectively.

Objectives To develop methods to haze and deter birds away from potential oil spills.

Methods

Phase I: Workshop

1. Convene a facilitated workshop of knowledgeable industry and governmental experts in the field of bird hazing and deterrence and/or allied fields.
2. Conduct a review of published and unpublished literature on this topic, for focal species (i.e., long-tailed duck, common eider, king eider, spectacled eider, loons, phalaropes).
3. Have these experts evaluate the apparent effectiveness of a suite of bird hazing/deterrent devices and techniques that may be used to haze birds from or deter their entry into the vicinity of an oil spill in the Beaufort Sea.
4. Have this panel design a detailed field testing protocol, based on this evaluation, for hazing and deterrence devices and methods that show the most promise for use in the Beaufort Sea environment under a variety of circumstances.
5. Select test and control sites based on aerial survey and other information on focal species distribution and behavior including oil spill scenarios projected by the MMS Oil Spill Risk Analysis model.
6. Summarize recommendations in workshop report.

Phase II: As appropriate, following the workshop, the following field work may be initiated:

1. Record bird species, flock sizes, and activity in test and control sites prior to initiating hazing/deterrence activities.
2. Expose bird flocks of varying flock size, species, activity, sex, and status (e.g., molting, non-molting) from major habitats used by these species under various oceanographic/climatic conditions (e.g., open-water, broken-ice, fog), timeframes (hours, days), and at various times during the period of presence (May-October) to selected devices, including Breco buoy, and techniques individually, and in combination and sequence; record numbers of individuals remaining by species, distance from hazing device(s), effort of hazing activities, and other appropriate measures of effectiveness.
3. Repeat the exposure experiments substituting a simulated oil spill scenario and utilizing multiple devices and/or techniques over an area comparable to that projected to occur after 10 days as a result of spilling the most likely volume of oil assumed by an MMS 2002 EIS.
4. Quantify differences in effectiveness of bird hazing from a simulated oil spill area in the Beaufort Sea using the most likely volume and discontinuous area projected by the Oil Spill Risk Analysis model.
5. Make recommendations for any modifications of recommended bird hazing kits and procedures in the Alaska Clean Seas (ACS) Technical Manual and Oil Discharge Prevention and Contingency Plan.

Date Information Required: A final report on the workshop proceeding is due April 2006.

Revised date: September 2005

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDIES PLAN 2006

Region: Alaska

Planning Areas: Cook Inlet

Title: Distribution and Abundance of Harbor Seals in Cook Inlet

MMS Information Needs to be Addressed: This study will provide a sound, scientific protocol for aerial surveys to evaluate harbor seals in the Cook Inlet/Shelikof Strait area. This study will provide information for NEPA analysis and documentation for proposed Cook Inlet Lease Sales and other NEPA reviews.

Actual Costs (in thousands):
FY 2003 $433
FY 2004 $47
FY 2005 $333
Total Cost: $813

Period of Performance: FY 2003-2006

Conducting Organization: National Marine Mammal Laboratory

Description:
Background Harbor seals have been identified as a "keystone" species in the Cook Inlet and Gulf of Alaska marine environment. They represent a top-level predator in the food chain and an abundant species that occurs on the OCS year-around. The western Gulf of Alaska/Cook Inlet population of harbor seals has declined drastically since 1976 (Pitcher 1990). Any perturbations that might be associated with Cook Inlet oil and gas activities could threaten this population. Information on the current trend in the population is needed to adequately assess potential effects of oil and gas activities. Harbor seal distribution could be affected by operations, and their abundance probably could be affected by a substantial oil spill.

Objectives To develop and use a sound, scientific protocol to conduct a multi-year/season series of aerial surveys to estimate the distribution and abundance of harbor seals in the Cook Inlet Area, and to identify factors contributing to variation in those estimates.

Methods

1. Review and refine the previously established protocol for harbor seals by aerial surveys including information gleaned from EVOS Prince William Sound harbor seal surveys.
2. Estimate relative abundance and density of hauled out harbor seals along the coast of Cook Inlet, and associated islands.
3. Correlate harbor seal densities along the coast with environmental parameters.
4. Develop and deploy remote camera systems for year-around use to identify factors

that impact the haul-out behavior of harbor seals at various sites in Cook Inlet and quantify the relationship between haul-out patterns and these factors.

5. Integrate findings of this study with those of the concurrent MMS satellite-tagging study “Movements and habitat use Harbor Seals in Cook Inlet”, in order to broaden the geographic extent of the data available to estimate the proportion of seals missed because they are in the water during aircraft surveys.

Date Information Required: A final report is due September 2006.

Revised date: September 2005

Region: Alaska

Planning Areas: Cook Inlet

Title: Movements and Habitat Use of Harbor Seals in Cook Inlet

MMS Information Needs to be Addressed: This study will provide valuable information about a harbor seal population (or populations) that is exhibiting a trend toward seriously declining abundance. The study will provide information that addresses public concerns raised during MMS outreach. Information on distribution, abundance and behavior will be used in pre- and assessments and could form the basis for post-development monitoring if oil or gas related development is undertaken in the MMS Cook Inlet Planning Area. Information will be useful for assessments and monitoring for Cook Inlet Lease Sale in 2006.

Actual Costs (in thousands):

FY 2004	$381
FY 2005	$516
FY 2006	$370
FY 2007	$61
Total Costs:	$1,328

Period of Performance: FY 2004-2007

Conducting Organization: National Marine Mammal Laboratory

Description:

<u>*Background*</u> In recent decades, the abundance of harbor seals has declined at several Alaskan locations. For example, counts of harbor seals at Tugidak Island declined 85% between 1976 and 1988 (Pitcher 1990); in Bristol Bay and the north side of the Alaska Peninsula, recent seal counts are less than 42% of 1975 numbers (Withrow and Loughlin 1995); and trend site counts in Prince William Sound suggest declines in harbor seal populations of approximately 63% between 1984 and 1997 (Frost et al. 1999). The significance and causes of these declines are unknown, but concern is rising about the present and future status of Alaska harbor seal populations, most notably in the Gulf of Alaska. Because of the proximity of the declining populations to Cook Inlet, and the inherent vulnerability of harbor seals to spilled oil, it is particularly important to assess the potential impacts of oil and gas activities on the harbor seal population in the Cook Inlet Region.

In Alaska, aerial surveys have generally been conducted during the molt period (August-September) when the number of seals hauled out is thought to be highest and the weather conditions are likely to be most favorable for flying. Haul-out patterns at other times of the year are not well known. Since any seal's activity budget includes a significant time away from haul outs, information is also needed about at-sea behaviors for oil spill risk assessment. This study would result in a coordinated benefit to ongoing MMS-funded aerial surveys of harbor seals by estimating a correction of survey counts for the numbers

of animals missed when they are not hauled out. It augments the ongoing MMS study entitled, "Distribution and Abundance of Harbor Seals" by providing a correction factor and other information on the distribution and behavior of seals away from established haul-outs.

Objectives The general goal of this study is to employ satellite telemetry to document the movements, foraging behavior, and habitat use of harbor seals in Cook Inlet. Specific objectives are to:

1. Enhance estimates of harbor seal abundance in Cook Inlet by determining and applying a correction factor to survey counts of harbor seals from concurrent aerial surveys at haul outs in Cook Inlet.
2. Obtain Cook Inlet-wide information on harbor seal relative abundance, distribution and behavior with emphasis on habitat other than major haul outs.
3. Identify and prioritize any specific habitat areas that are or particular importance to the Cook Inlet harbor seal population(s) for specific activities such as feeding, breeding, pup rearing, wintering, etc.
4. Conduct a comprehensive evaluation of whether individual populations (or stocks) exist in the MMS Cook Inlet planning area.

Methods

1. Capture and instrument 30 seals in each of 3 successive years (N = 90) with Argos satellite-linked time-depth recorders (TDR's). Seals to be instrumented would include approximately equal proportions of juveniles, adult females and adult males each year. Seals would be captured from locations throughout Cook Inlet, in relative numbers that are proportionate to local abundance.
2. Develop necessary statistical analyses or statistical models to produce a correction factor for harbor seal abundance derived from aerial surveys at haul outs.
3. Use movement and behavioral data from this study with any existing published results or other data in a comprehensive analysis of harbor seal distribution and habitat use in, or adjacent to, the MMS Cook Inlet Planning Area.
4. Use text, maps, photographs or other data summaries to portray harbor seal distribution and habitat use in Cook Inlet for use in oil spill risk analysis.
5. Produce a synthesis of movement data, and other existing evidence (e.g., genetic analyses or tagging studies) to evaluate whether individual populations (or stocks) exist in the MMS Cook Inlet planning area. Use tissue samples obtained from instrumented seals for supplemental genetic analyses, if needed.

Date Information Required: Quarterly and annual reports are due in 2004, 2005, and 2006. A final report is due July 2007.

Revised date: September 2005

Region: Alaska

Planning Area: Lower Cook Inlet

Title: Survey of Steller's Eiders Wintering in Lower Cook Inlet

MMS Information Needs to be Addressed: Related potential risk to Steller's eider populations can best be understood if temporal and spatial variation in the distribution of Steller's eiders wintering in lower Cook Inlet is fully documented. Information will be used for NEPA analysis and documentation for the Cook Inlet Lease Sales, DPP's, and risk analysis.

Actual Costs (in thousands): **Period of Performance:** FY 2004-2006

FY 2004	$50
FY 2005	$58
Total Costs:	$108

Description:

Background In 1997, the Alaska-breeding population of the Steller's eider was listed as threatened under the Endangered Species Act. The decision to list was based on the observed substantial decrease in the nesting range of Steller's eiders breeding in Alaska, the overall reduction in numbers of Steller's eiders nesting in Alaska, and the increased vulnerability of the remaining breeding population to extinction according to a USFWS document of 2001.

Steller's eiders that breed in northern Alaska and Russia winter in the lower Cook Inlet, but the distribution and abundance of the species is currently uncertain. Moreover, the relative proportion of birds wintering in Cook Inlet from the Russian population versus the threatened Alaska population in not known. Opportunistic observations indicate that Steller's eiders, numbering in the hundreds to thousands, winter in lower Cook Inlet (Unpublished USFWS Reports, Larned 1997, 2001). Steller's eiders have frequently been observed along the Homer Spit, arriving in early- to mid-November and departing by the end of April. Concentrations of wintering Steller's eiders have been reported from both the eastern and western coastlines of Lower Cook Inlet, but the majority of the sightings have been reported from the shoal extending from the Homer Spit, westward in Kachemak Bay, around Anchor Point and northward to Clam Gulch

A cooperative study between the USFWS and MMS in 1993-1994 suggested that aerial surveys were much more effective than offshore boat surveys for detecting flocks of Steller's eiders. Systematic aerial surveys to identify the timing and location of Steller's eiders that winter in lower Cook Inlet would be useful for ongoing analyses of the environmental consequences of potential oil and gas development proposed for that area by MMS.

Objectives

1. Identify locations important to Steller's eiders wintering in lower Cook Inlet.
2. Understand temporal variation in Steller's eiders winter use of the waters in lower Cook Inlet.
3. Estimate numbers of Steller's eiders wintering in lower Cook Inlet.

Methods Surveys will be flown in lower Cook Inlet by experienced observers along transects perpendicular to the coastline in fixed-winged aircraft. Coverage will be from the shoreline to the 20 m isobath. Surveys will be flown monthly from December through early-April for a total of 5 surveys per year for 2 years.

Date Information Required: A final report is due December 2005.

Revised date: September 2005

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDIES PLAN 2006

Region: Alaska

Planning Areas: All Alaska Planning Areas

Title: Publication of a Book/Synthesis on the Socioeconomic Effects of Oil and Gas Industry Activity on the Alaskan OCS

MMS Information Needs to be Addressed: Throughout Alaskan coastal communities there are socioeconomic-related issues resulting from proposals for offshore oil and gas development. This study will provide a peer-reviewed synthesis of current information for use in decision making. The study information will be used for NEPA analysis and documentation for Beaufort Sea Lease Sales, Cook Inlet Lease Sales Chukchi/Hope Lease Sales, DPP's, and ongoing outreach efforts.

Actual Costs (in thousands):
FY1998 $349
Total Cost: $349

Period of Performance: FY 1998-2006

Conducting Organization: Stephen Braund & Associates

Description:
Background The Alaska OCS Region has implemented an important socioeconomic component of its overall Environmental Studies Program, resulting in the publication of more than 160 Technical Reports addressing statewide socioeconomic study topics. Methodologies have included case studies, institutional profile analysis and analysis of secondary-source materials, modeling and econometrics analysis, and survey research. In recent years, socioeconomic studies have become more focused and issue-oriented, emphasizing the critical points between OCS development and social systems with which potential development would interact. For example, studies have collected time-series information and measures of community and regional well being as bases for social-indicators monitoring.

Considering the extent of MMS's social research in Alaska and the substantial information accumulated, a workshop examining the usability of the current research in its original forms versus the costs and benefits of further synthesis was recently conducted. In planning for the preparation of a useful resource document resulting from the workshop efforts, the workshop participants identified a tentative outline, chapter integration, and potential co-sponsors.

The level of information regarding changes in the socioeconomic environment related to OCS activities is varied—without a comprehensive formal, comparative, quantitative, and qualitative documentation of existing data, this information is of limited use to decision makers.

Objectives The objective of this study is to coordinate and prepare a peer-reviewed book/synthesis of available information about the potential socioeconomic effects of oil- and gas-industry activity on the Alaska OCS.

Methods The study will finalize the book/synthesis outline; integrate chapters; identify the author; and solicit potential co-sponsors. MMS funded studies will be the primary source of reference materials plus subsequent studies that were initiated from these findings. To be considered as source material, the literature must be related to oil and gas activities in Alaska and peer-reviewed. The topics to be addressed will be narrowed specific to the information available through this literature search which will also serve to identify potential authors. These authors may also identify additional sources of information for synthesis.

Date Information Required: The final published book is due July 2006.

Revised date: September 2005

Region: Alaska

Planning Areas: Beaufort Sea

Title: Quantitative Description of Potential Impacts of OCS Activities on Bowhead Whale Hunting and Subsistence Activities in the Beaufort Sea

MMS Information Needs to be Addressed: Leaders of the North Slope Inupiat communities, including elders, have for many years expressed concern about potential impacts to their subsistence way of life. This study is important in its capacity to effectively measure and document such concerns and for its potential utility in future decision-making processes. This information will be used for NEPA analysis and documentation for Beaufort Sea Lease Sales and DPP's.

Actual Cost (in thousands):
FY 2001 $212
FY 2002 $347
Total Cost: $559

Period of Performance: FY 2001-2006

Organization Conducting: EDAW, Inc.

Description:
Background The residents of Nuiqsut, Kaktovik, and Barrow are close to the oil industry activity onshore on the North Slope and in the adjoining Beaufort Sea. Subsistence is central to the Inupiat people residing on the North Slope. Virtually all Inupiat residents rely on subsistence resources directly or through kinship sharing. Bowhead whaling is especially important and impacted if OCS activity causes reduction in whale hunting success. Inupiat leaders, including elders, have expressed concern about the effects of potential oil spills on bowhead whaling and cumulative impacts of past, present and future oil industry activity onshore and offshore. At a meeting in Barrow in March 2000 elders defined two principal questions concerning cultural, social and economic impacts:

A. Regarding offshore oil and gas activities, do people in Barrow, Nuiqsut and Kaktovik feel that these activities have: a) resulted in positive social, economic or cultural impacts to their community, and/or b) resulted in negative social, economic or cultural impacts to their community?

- If members of a community feel there have been positive social, economic or cultural impacts to their community, what are the positive impacts and how can they be quantified?

- If members of a community feel that there have been negative social, economic or cultural impacts to their community, what are the negative impacts and how can they be quantified?

B. What kind of support would need to be put in place to enable Alaskan Eskimo subsistence communities to continue subsistence activities and keep traditional subsistence ways of life intact in the event of an oil spill or cumulative impacts (including air and/or water pollution and noise) that make subsistence resources locally unavailable?

Several studies have been done which address certain aspects of potential sociocultural impacts on the North Slope. This study would update some older studies and provide information not previously collected in other aspects.

Objectives To quantitatively estimate the social and cultural impacts of OCS oil and gas exploration, development, and production in the Beaufort Sea on the communities of Nuiqsut, Kaktovik, and Barrow; and to recommend mitigation measures.

1. Identify what people observe and anticipate as the positive impacts and opportunities of OCS activities.
2. Identify what people observe and anticipate as the negative impacts and risks of OCS activities.
3. Quantitatively describe direct impact experiences and anticipated experiences by bowhead hunters.
4. Document actual experiences and match the impact with the reporting unit experiencing the impact (e.g., whaling crews, households, individual hunters, elders).

Methods

1. Review the literature, including previous testimony, and make a preliminary list of North Slope impacts and concerns expressed by residents (positive and negative). Review the methodologies and survey questionnaires used in the social indicator studies conducted by MMS in the 1990's for possible use in this study. Gather a thorough list of residents' observed and anticipated impacts and concerns through focus group meetings in Nuiqsut, Kaktovik, and Barrow. Potential impacts would likely include, among others, pollution, noise, and other factors that may make bowhead whales and other marine resources more difficult to hunt or unavailable. Collect information on residents' views of possible remedies or mitigation measures related to those concerns and impacts. Design the list of impacts in such a way as to separate OCS-related impacts from other impacts as much as possible. Circulate this list of impacts and mitigation possibilities to the NSB, AEWC, village contacts as appropriate, and MMS.
2. Use the literature and focus group data to develop a draft questionnaire. Distribute that questionnaire to the NSB, AEWC, SRB, village contacts, and MMS for review and comment. Pretest the questionnaire (N<10) in the communities, make revisions as appropriate, and re-circulate the questionnaire for final review. Obtain approval from

the Federal Office of Management and Budget as required for federally funded questionnaires, estimated to take 6-8 months. Develop interviewer guides (question by question, tracking, and reporting procedures) and conduct an interviewer training session.

3. Coordinate with NSB, AEWC, and community contacts to enable face-to-face interviews in Barrow, Nuiqsut, and Kaktovik. Due to its large size and socio-demographic heterogeneity, use a stratified, representative, and randomized sampling strategy in Barrow. Attempt to interview randomly selected adult members in all households in Nuiqsut and Kaktovik, with the expectation of a response rate of over 80 percent. Select a subsistence-oriented Arctic or sub-Arctic control community outside of the North Slope and conduct a representative and randomized sample of interviews there. Ideally, members of the control community will hunt bowhead whales.
4. Code the surveys, enter data into SPSS (or equivalent statistical package), check, and edit. Use basic univariate and bivariate analyses to generate valid and reliable descriptive information for inclusion in summary tables and graphs, and to provide quantitative-oriented but readily understandable descriptive discussion in the draft and final reports. Use multivariate analysis to explain variation in the data and to provide quantitative-oriented but readily understandable explanatory discussion in the draft and final reports. Draw from findings about respondent's ideas for potential mitigation measures to develop a draft recommendation section.
5. Develop a draft report and present it to the AEWC, NSB, Scientific Review Board`, and village contacts in Nuiqsut and Kaktovik for extensive input and commentary.
6. Finalize the draft report based on the input and commentary of interested parties and present and disseminate study findings to those parties.
7. Coordinate all steps above with other potential planned studies.

Date Information Required: A final report is due October 2005.

Revised date: September 2005

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ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDIES PLAN 2006

Region: Alaska

Planning Areas: Beaufort Sea

Title: Subsistence Mapping at Nuiqsut, Kaktovik, Barrow, and Wainwright: Past and Present Comparison

MMS Information Needs to be Addressed: The information will be used for NEPA analysis and documentation for Beaufort Sea Lease Sales and DPP's.

Actual Costs (in thousands): **Period of Performance:** FY 2002-2006
FY 2002 $189
FY 2003 $211
Total Cost: $400

Conduction Organization: Stephen A. Braund and Associates

Description:
Background MMS conducted studies providing detailed mapping of a wide range of subsistence activities for Nuiqsut, Kaktovik, and Barrow about 1990. Information is available from recent subsistence scientific, private, and government sources. For example, ADF&G has done some detailed mapping of subsistence activities for these three North Slope s villages since 1990 but the mapping needs to be put in usable form. MMS assesses cumulative effects in EIS's and, therefore, needs documentation on more current subsistence patterns for comparison between 1990 and the present. Exploration on the offshore, including the OCS, and much onshore development has taken place since 1990. Much oil and gas infrastructure has been built onshore since 1990. Northstar is the first offshore oil development connecting to the onshore developments centered at Prudhoe Bay and it began production in 2001. This study will coordinate with the documentation of subsistence activities at Cross Island, which is part of the ongoing "Arctic Nearshore Impact Monitoring In Development Areas" (ANIMIDA) study and continuation of that study. It will utilize information from the MMS-sponsored study which compiled GIS overlays of oil-industry and other human activities for the 1979-1998 period in the Beaufort Sea.

Objective Develop a Geographic Information System (GIS) to map and analyze changes in and potential interactions between subsistence activities and oil industry activities.

Methods

1. Consult with key organizations to refine the scope of work for the study and to plan for conduct of the study. Such organizations may include the NSB Planning and Wildlife Management Departments, Alaska Eskimo Whaling Commission (AEWC), Inupiat Community of the Arctic Slope, the Native Villages of Barrow, Nuiqsut and

Kaktovik, and ADF&G Subsistence Division, and others as appropriate

2. Compile information regarding subsistence geospatial patterns from MMS sponsored and other studies conducted in Nuiqsut, Kaktovik, Barrow and Wainwright during the 1990s. Assess the quality of existing geo-spatial data and convert to GIS format where possible.
3. Compile current information on subsistence activities and use of resources for Nuiqsut, Kaktovik, Barrow, and Wainwright as available from recent work conducted by scientific, private, and government entities. Gather primary source data regarding current subsistence effort, and use of resources from knowledgeable key informants resident in Nuiqsut, Kaktovik, and Barrow. The data collection effort will coordinate with other relevant MMS studies.
4. Generate maps depicting where subsistence activities are currently taking place and at what level of intensity. Products will show potential changes in harvests, access to resources, competition for resources, costs, effort, and levels of risk.
5. For each subsistence activity map, provide context describing in standardized and specific terms the nature and source of the data.
6. Develop overlay maps depicting changes in subsistence activities and changes in oil and gas activities. Develop analysis to address potential cumulative-effect dynamics occurring between subsistence and oil and gas activities. Develop descriptive context to augment the analysis.
7. Review and evaluate effectiveness of current federal and state mitigation associated with oil and gas activity regarding potential displacement of subsistence resources and resource users.
8. Review graphic and written analysis with key informants and key organizations including but not limited to those identified in 1 above. Disseminate ongoing and final products of study to local residents through village workshops and integrate workshop feedback into the final analysis.
9. Input all final spatial information on subsistence and industry activity into a GIS format.
10. Make resulting information available to the public on CD-ROM.

Date Information Required: The final set of maps is due July 2006.

Revised date: September 2005

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDIES PLAN 2006

Region: Alaska

Planning Areas: Beaufort Sea and Lower Cook Inlet

Title: Researching Technical Dialogue with Alaskan Coastal Communities: Analysis of the Social, Cultural, Linguistic, and Institutional Parameters of Public/Agency Communication Patterns

MMS Information Needs to be Addressed: Since MMS primarily communicates to a diverse public through the preparation of regulatory measures, EIS's, and other documents, an analytic investigation of alternative communication processes and their effects on key constituents is needed. This study will evaluate the effectiveness of various communication strategies, explore prospects for altering future communication efforts, and seek to make agency communication more effective in the Alaska region. By reducing miscommunication with stakeholders, this study will enhance the ability of the public to participate more fully in the NEPA process. Information is needed by FY2006.

Actual Costs (in thousands):
FY 2004 $200
FY 2005 $100
Total Cost: $300

Period of Performance: FY 2004-2006

Conducting Organization: EDAW, Inc.

Background: Technical dialogue plays an important role in shaping OCS decisions, yet relatively little research has been devoted to investigate the communication processes between technical professionals and citizen stakeholders. Some research of this nature has been done, but not in Alaska, where distinctive resource management issues and distinctive social, cultural, linguistic, and institutional differences exist. Previous social research indicates that differing knowledge bases and paradigms routinely complicate the communication efforts of federal institutions in Alaskan coastal communities. Some agencies have already made significant progress in efforts to assess and improve the effectiveness of their written communication methods with the public.

The proposed research would specifically investigate the effects of MMS written communication efforts in selected coastal communities and try to improve communication processes with local stakeholder groups. It would systematically identify and analyze potential communication obstacles and then pursue remedies through pilot-testing a series of experimental "newsletters" on targeted focus groups. Is MMS successfully communicating the messages that it intends to communicate? Does a particular communication have any measurable effect on relevant local understandings? Are unintended messages being communicated? Can MMS improve communication techniques through cost efficient measures? Can issues of public trust be addressed through a more effective written communication process?

If specific written communication problems can be identified through controlled testing, the study would then seek to provide both a rationale and a method to explore potential changes in future agency communication strategies with regard to:
- message content
- mechanisms of message delivery
- timeliness of communication
- availability and use of supporting materials and information

Objectives

1. Assess the measurable effectiveness of MMS written communication methods with various communities of coastal Alaska.
2. Identify potential obstacles in MMS written communication efforts and develop a strategy for their amelioration.
3. Generate specific recommendations for improved written communication methods and for their implementation in agency processes.
4. Improve prospects for public/agency communication and collaboration in resource management issues of the Alaskan OCS.

Methods

1. Analyze and catalogue the record of public comments from Cook Inlet and the Beaufort Sea to assess the scope and character of manifest communication issues and regional opinions about offshore oil development and MMS regulatory processes.
2. Conduct a literature search to assess alternative federal agency written communication efforts with local populations that are relevant to MMS goals and processes.
3. Identify appropriate samples of study participants in communities on the North Slope and the Kenai Peninsula.
4. Devise a cost effective procedure to create focus groups to assess public knowledge and attitudes about the OCS regulatory environment, the communication of scientific and technical information, and key agency messages.
5. Work with MMS management and staff to prepare new (theory-driven) textual materials to disseminate agency statements under controlled and variable circumstances, including the preparation and distribution of various "newsletters" to compare their effectiveness as measured across a range of key variables.
6. Monitor changes in understanding, perceptions of OCS management, and durability of opinions among study participants because of pilot-test materials.
7. Continue to test and monitor communication efforts in a limited and controlled newsletter format until a model based upon "lessons learned" can be implemented.
8. Coordinate communication processes with other relevant MMS studies.

Date Information Required: A final report is due July 2006.

Revised date: September 2005

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDIES PLAN 2006

Region: Alaska

Planning Areas: Cook Inlet / Beaufort Sea

Title: Dynamics of Distribution and Consumption of Subsistence Resources in Coastal Alaska

MMS Information Needs to be Addressed: The information from this will be used for NEPA analysis and documentation for Beaufort Sea and Cook Inlet Lease Sales and DPP's.

Actual Costs (in thousands) **Period of Performance:** FY 2006-2007
FY 2006: In procurement, TBD

Description:

Background Many previous MMS studies have documented various aspects of subsistence harvest throughout Coastal Alaska. These studies have identified and hypothesized patterns of change within subsistence-oriented behaviors that occur in association with local changes in income level, demographics, access to resources, and wildlife population/habitat change.

We have learned, for example, that there tends to be a positive relationship at a household level between cash income and subsistence production, including capital investments in subsistence activities, magnitude of harvest levels, diversity of species harvested, and range of food distribution networks. Previous studies have also contemplated the interactions of oil development and infrastructure expansion with subsistence patterns on the arctic North Slope, including perceived negative impacts on harvests and reported displacement of hunters from oil production fields. Subsistence issues always dominate the public testimonial record, amply demonstrating the continued importance of food harvest, distribution, and consumption to coastal communities and the persistence of their concern over potential cumulative impacts from oil and gas development on social and cultural continuity.

Over the years, MMS has produced a wealth of information about household subsistence harvests by quantity, location, species, and month of harvest. But our research has not yet explored systematically the equally important latter half of the subsistence process: the complex social dynamics of sharing and consuming resources after they are harvested. In Native communities, the distribution and exchange of subsistence resources have traditionally operated under complex codes of participation, partnership, and obligation. It is thus plausible that incremental changes in subsistence activities could have corresponding social system effects.

Objectives This study will:

1. Explore, quantify, and document the social dynamics and significant changes of subsistence resource distribution and consumption for residents of selected coastal communities of Cook Inlet and the Beaufort Sea over time.
2. Quantify (through baseline and trend data) and explain (through ethnographic fieldwork) any identifiable changes in the social distribution or consumption of subsistence resources over time and geographic space.
3. Evaluate from the empirical research the need for further research by assessing whether any documented changes in subsistence activities might feasibly produce substantial changes in the dietary behaviors and health status of identifiable Native groups (such as elders, single women, children, adolescent males, unskilled hunters, etc.).

Methods

1. Conduct a literature search on the social dynamics of distributing and consuming subsistence resources in the Cook Inlet and Beaufort Sea regions of Alaska; Identify what has been documented to date.
2. Statistically evaluate the utility of building upon previous data sets to establish the needed statistical validity and power to establish adequate baseline and trend data for this study.
3. Prepare a strategic survey instrument that is both statistically and socially appropriate, and obtain OMB approval to use it.
4. Coordinate with local communities and appropriately conduct the surveys where feasible.
5. Conduct supplementary ethnographic fieldwork to secure the reliability of collected survey data and to obtain the "emic" perspective necessary to interpret and explain survey results.
6. Assess the field data and estimate confidence in / significance of changes in distribution or consumption of subsistence resources.
7. Explain any documented changes by reference to fieldwork and published literature.
8. Conduct post-fieldwork meetings with appropriate individuals in surveyed communities to cross-check and review fieldwork results.
9. For statistically significant observed relationships, assess the plausibility of linkages between a) regional changes in subsistence and oil development activities and b) changing dynamics in the social distribution and consumption of subsistence resources; assess the need for further research to explore any implications for changing dietary behaviors and health status for identifiable members of coastal communities.
10. Report the results to participating communities through public meetings or workshops.

Date Information Required: A final report is due September 2007.

Revised date: September 2005

Region: Alaska

Planning Areas: All

Title: Social and Economic Assessment of Major Oil Spill Litigation Settlement for the Alaska OCS Region

MMS Information Needs to be Addressed: The potential social costs of major coastal oil spills are a public concern associated with OCS development in the U.S. Insofar as the effects of EVOS continue to frame community response to oil and gas development, comprehensive understanding of the event and its various effects are of MMS information needs to be addressed: Alaska OCS Region. This study will be used in EA's and EIS's for predicting and mitigating social effects potentially resulting from major oil spills and resulting oil spill litigation. This information will be used for NEPA analysis and documentation for Beaufort Sea Lease Sales, Cook Inlet Lease Sales, Chukchi/Hope Basin Lease Sales, and DPP's.

Actual Costs (in thousands): **Period of Performance:** FY 2003-2006

FY 2003	$204
FY2005	$ 48
Total Costs:	$252

Conducting Organization: Impact Assessment, Inc.

Description:

<u>*Background*</u> Major oil spills such as the 1978 Amoco Cadiz and 1989 *Exxon Valdez* oil spill (EVOS) events led to a variety of documented social and economic effects. But spill-related litigation and settlement processes and their effects have not been a common topic of socioeconomic research. Regarding EVOS, social scientists speculate that final settlement and distribution of award monies will lead to various beneficial and detrimental secondary effects in addition to those related to the original spill and cleanup events and subsequent phases of litigation. The nature and intensity of such effects hypothetically relate to socioeconomic, demographic, and other attributes of recipients, and to the nature of experience with the spill and litigation.

A recently completed MMS-sponsored study about EVOS, its cleanup and litigation, which collected social impacts information and analysis, provides a comprehensive qualitative overview of general information which will provide useful background to the present quantitative effort.

<u>*Objectives*</u> Analyses of data collected in spill-affected communities soon after the EVOS event report that existing social problems were heightened in relation to the influx of spill clean-up monies and resources, particularly in rural-Native communities where access to subsistence resources was limited. Subsequent analyses suggest that larger communities have benefited from opportunities such as eco-tourism that were not extant before the spill. It may be hypothesized that spill clean-up and restoration monies and resources served to amplify social, demographic, and economic trends and attributes of the

awardees in all cases at individual, familial, and community levels of analysis. The objective of this study is to test this hypothesis given potential future influx of monies and resources via final litigation settlement.

Methods The study will require compilation and analysis of existing data, collection of new pertinent information, coordination with similar research conducted in the region, detailed comparative analysis, and development of summary conclusions. The methods are:

1. Compile and summarize existing data and scholarship regarding pre- and post-EVOS socio-economic conditions and trends on Kodiak Island. Continue to monitor annually updated public access data for changes in demographic trends throughout the study period.
2. Secure ethnographic research access from appropriate local authorities in two different Kodiak village communities. Also secure ethnographic research access to the City of Kodiak.
3. Conduct ethnographic fieldwork in all three Kodiak locations. The fieldwork will involve community level participant-observation in relevant public forums, as well as open ended conversations with a sample of community households in each location from different levels of socioeconomic strata. The fieldwork is intended to gather information about potential changes in key socioeconomic indicators such as: residency and migration patterns, occupational profiles, patterns of investment and return, specialization vs. diversification in commercial fishing operations, specialization vs. diversification in traditional subsistence activities, and other selected social practices.
4. Conduct focus-group forums in all three fieldwork locations to supplement and compare with insights gained from step 3 above. It is expected that different community-level concerns and issues relevant to the litigation settlement process will surface in a focus-group forum that go unexpressed at household level conversations.
5. Analyze the various data compiled above to develop a descriptive comparative analysis of the interim socioeconomic effects and expectations of the litigation experience in each community under investigation. Report the findings at the end of project Phase One (prior to final spill litigation settlement/award distribution).
6. After a final litigation settlement is reached, conduct a second round of fieldwork to gather comparable data for the same categories of variables from all three communities. Analyze the data and report the findings at the end of project Phase Two (some months after the final distribution of settlement awards).
7. Produce a detailed written summary analysis that is responsive to the original hypothesis of the project. Report on major insights and general recommendations relevant to the effective management of future potential oil spills and related litigation and settlement.

Date Information Required: A final report is due after final EVOS litigation which is pending as of September 2005.

Revised date: September 2005

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDIES PLAN 2006

Region: Alaska

Planning Areas: Beaufort and Chukchi Seas and Hope Basin

Title: North Slope Borough Economy, 1965 to Present

MMS Information Needs to be Addressed: This study will be useful to MMS in assessing potential economic impacts of OCS development activity on the NSB and NSB residents with respect to revenues and expenditures, employment, subsistence and migration. This information will be used for NEPA analysis and documentation for Beaufort Sea Lease Sales and DPP's.

Actual Costs (in thousands):
FY 2002 $99
FY 2005 $46
Total Cost: $145

Period of Performance: FY 2003-2006

Conducting Organization: Northern Economics, Inc.

Description:
Background The focus of the social and economic studies of the MMS Alaska OCS Region has been the potential for increase in offshore oil and gas activity. Many MMS socioeconomic studies were based on scenarios of change from no-industry activity to development-stage activity. However, through 1999, industry activities in all Alaska OCS leased areas had gone only to the exploratory phase, and industry activities onshore in Alaska currently are in decline. Although there was much greater production in the 1980's, reduced production at Prudhoe Bay fields in the 1990's and attractive international exploration and development opportunities are additional factors affecting property tax revenues to the NSB. This historical economic activity and its effect on NSB revenues/expenditures, provides a context for anticipated offshore development and production at Northstar and, if approved, Liberty and their potential effect on regional and local economies. A descriptive characterization of historic and recent North Slope economic activity due to onshore activities is necessary in order to evaluate relative significance of projected offshore development.

Objectives

1. Describe revenues and expenditures of the NSB, 1965 to the most current year available.
2. Portray how the NSB, as the local government, and individuals and households anticipate dealing with decline in revenues from the oil industry.

3. Describe the structure of NSB economy and changes to the structure, 1965 to the most current year available.

4. Describe the role of the regional Native corporation in the economy.
5. Provide a comparative basis for assessing potential economic effects of upcoming offshore oil and gas activity.

Methods

1. Make a quantitative and narrative description of NSB revenues and expenditures for each year from 1965 through the most current year available for capital projects. Classify local government services by departments of the NSB and other major categories.
2. Using the institutional profile analysis method focusing on key informants, describe how the NSB, as the local government, anticipates responding to a decline in revenue.
3. Also using key informants, describe how individuals and households anticipate responding to a possible economic change, such as doing more subsistence hunting or moving to areas in Alaska where cash jobs are available. Focus on the family (households), personal income, and sources of income for the families.
4. Using data from the NSB and State Department of Labor, describe the structure of the NSB economy and changes, 1965 to the most current year; i.e., employment by sector of the economy and employer. Analyze local jobs and the types of jobs. Describe the flexibility of jobs in relation to subsistence (for example, getting time off to engage in subsistence. Using the best data available, describe in- and out-migration).
5. Describe the role of the regional Native Corporation, Arctic Slope Regional Corporation, in the North Slope economy, both in quantitative and narrative form.
6. Coordinate the study with NSB officials, as needed.

Date Information Required: A final report is due December 2006.

Revised date: September 2005

Region: Alaska

Planning Areas: Beaufort Sea

Title: Continuation of Arctic Nearshore Impact Monitoring in Development Area (cANIMIDA)

MMS Information Needs to be Addressed: Northstar construction started during the ANIMIDA study and production started in November 2001. Liberty, if initiated, could start construction sometime during the period of cANIMIDA. Interagency reviews of related EIS's and Development and Production Plans recommend monitoring effects of Northstar and the possible Liberty development. There is a continuing, ongoing need for this monitoring information during the performance period of the study, which will coincide with production from Northstar and possible Liberty construction. The information will be used for NEPA analysis and documentation for Beaufort Sea Lease Sales and DPP's.

Actual Costs (in thousands):
FY 2003: $100
FY 2004: $1,203
FY 2005: $703
FY 2006: $857
FY 2007: $637
Total Cost: $3,500

Period of Performance: FY 2003-2008

Conducting Organization: Battelle; LGL, Alaska; Applied Sociocultural Research

Description:

<u>*Background*</u> The Arctic Nearshore Impact Monitoring in Development Area (ANIMIDA), a five-year study started in 1999, has provided baseline data and monitoring results for chemical contamination, turbidity, and subsistence whaling in the vicinity of Northstar and Liberty development sites. Northstar is in State waters, but includes production of some OCS oil through directional drilling. Liberty, if approved, will be the first offshore OCS development project in the Beaufort Sea or elsewhere in the Alaska OCS. ANIMIDA monitoring for Northstar includes pre-construction, and construction, and early production periods. The last field sampling for ANIMIDA is scheduled for spring 2003. This study started field work in FY 04, with an initial planning phase and Core Contractor funded and procured under FY 03 appropriations.

<u>*Objectives*</u> This study will gather long term monitoring data which will provide a basis of continuity and consistency in evaluation of potential effects from site-specific, recently initiated development and upcoming production in the Beaufort Sea OCS. Currently, these site-specific areas include the Northstar and Liberty areas, other prospects would be included if proposed for development. Priority monitoring issues will be established

through public and interagency comment, and coordinated with lessees and other organizations. At minimum, we expect cANIMIDA to continue the following ANIMIDA objectives:

1. Hydrocarbon and metal characterization of sediments, bivalves and amphipods in the study area.
2. Annual assessment of subsistence whaling near Cross Island.
3. Sources, concentrations, and dispersion pathways for suspended sediment.
4. Monitoring the Boulder Patch.
5. Characterization of anthropogenic contaminants in upper tropic biota.

Methods Field logistics for both phases include helicopter support and small vessel (e.g., MMS Launch 1273) support in the "open" water season and snow machine/rolligon support in winter/spring. Samples will be collected from construction gravel pits, artificial islands, rivers, barrier islands, and sediment from ANIMIDA offshore stations and along the proposed Liberty pipeline route.

Turbidity, total suspended sediment, current velocity measurements are being made in the vicinity of construction, spoils dumps and other sites including local rivers and the Boulder Patch. Sediment and suspended sediment samples will be analyzed for PAH, trace metals, and supporting chemistry using methods consistent with prior ANIMIDA analyses. Biota sampling (species and contaminants measured) will be based on results and recommendations from ANIMDIA. Kelp productivity will be monitored in the Boulder Patch and will use the inherent optical properties of the ice and water to evaluate the effect of sediment resuspension on kelp productivity. Optical-related measurements will include spectral irradiance, light scattering coefficients, and total suspended solids. The reporting program for Cross Island whaling, which records information on whaling locations, success, and whaler perceptions, will be supported. Field programs will be scheduled in 2003-2006. Year 5 (FY2007) will be devoted to reporting of monitoring results.

Date Information Required: Annual reports are due 2005 and 2006 and a final report is due in 2007.

Revised date: September 2005

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDIES PLAN 2006

Region: Alaska

Planning Areas: Chukchi Sea, Hope Basin, Norton Sound, Cook Inlet

Title: Update of Environmental Information for Cook Inlet, Chukchi/Hope Basin and Norton Basin Planning Areas

MMS Information Needs to be Addressed: Annotated bibliographies will be useful to MMS analysts for purposes of evaluating the effects of OCS oil and gas developments. They will also help inform individuals from other organizations and the general public about the current status of the Alaska OCS human, marine, and coastal environment, and thereby facilitate the EIS review process. Bibliographies are needed for EIS's for NEPA analysis and documentation for the Cook Inlet Lease Sale, Chukchi/Hope Basin Lease Sales, and Norton Planning Area Lease Sales, depending on nominations received.

Actual Costs (in thousands): **Period of Performance:** FY 2003-2006
FY 2003 $150
Total Cost: $150

Conducting Organization: LGL, Alaska Research Associates

Description:
<u>*Background*</u> In the *Final Proposed Outer Continental Shelf Oil and Gas Leasing Program 2002-2007* (September 2002), the MMS proposes lease sales in Cook Inlet, Chukchi/Hope Basin and the Norton Basin Planning Area. Since it has been several years, or longer, since EIS's were written to describe potential developments in those areas, MMS literature reviews are now somewhat out of date. Updated literature surveys would potentially benefit MMS analysts, representatives of other agencies and organizations and the general public in efforts to evaluate the effects of proposals to develop OCS oil and gas in the above planning areas.

<u>*Objectives*</u> Make available new scientific information on the biology and status of important vertebrate species for easy access by MMS analysts, representatives of other agencies and organizations and the general public.

<u>*Methods*</u> Conduct a literature survey and prepare an annotated bibliography of new scientific information (past 5-10 years, depending on area) on fish, marine mammals, marine birds, ecosystems, and human social systems that might be affected by oil and gas development in the OCS. Potential sources of information include, but are not limited to:

1. Primary scientific literature and books.
2. Unpublished reports, analyses, and other accessible documents.
3. Other sources such as internet homepages and accessible data bases.

These objectives will be accomplished in coordination with other ongoing studies, as appropriate, to avoid duplication.

Date Information Required: The final report is due December 2005.

Revised date: September 2005

Region: Alaska

Planning Areas: Beaufort Sea

Title: Beaufort Sea and North Slope Pipeline GIS Database

MMS Information Needs to be Addressed: The Oil-Spill-Risk Analysis (OSRA) is a cornerstone to regional EIS's environmental assessments, and oil-spill-contingency planning. Oil-spill issues constitute a significant portion of public comments submitted on sale or development EIS's in the Alaska OCS Region. This information also provides a corner stone for analyzing the spatial extent of cumulative impacts of oil pipeline development through time. MMS will use the information from this study in preparing NEPA analysis and documentation for Beaufort Sea Lease Sales, DPP's, and in reviewing oil-spill-contingency plans.

Actual Costs (in thousands):
FY 2002 $ 78
FY 2004 $285
Total Cost: $363

Period of Performance: FY 2002-2006

Conducting Organization: Michael Baker, Jr. Inc.

Description:
Background The MMS has primarily used the historical spill record on the OCS as an indicator of future spill occurrence rates on the OCS. This spill record does not include pipeline spills shoreward of the OCS, in State waters, or on land. The MMS intends to calculate spill rate occurrence based on Regional considerations, such as the Alaska North Slope production and pipeline experience, and to include all major pipeline spills, both onshore and offshore in environmental impact assessment. The first step in this process was a prior MMS-sponsored 1999-2000 study which collated available information on oil spills of at least 100 barrels (bbl) and provided preliminary evaluation of spill occurrence rates.

One objective of this prior study that could not be accomplished was to evaluate usefulness of pipeline length as predictor or co-predictor (with pipeline throughput) for North Slope and Trans-Alaska Pipeline System (TAPS) spillage. This objective required concomitant pipeline segment throughput and pipeline segment length information at yearly or better intervals. The prior study did not have the available resources to collect the comprehensive data on field gathering lines necessary to complete the analysis. Construction of a database of that information base was beyond the scope of that study.

Objectives This study is in two Phases. Phase II will not be funded unless significant information is deemed obtainable through the efforts of Phase I.

Phase I:

1. Establish how much of the construction history (length, location) and throughput history can be reconstructed from industry, government, mapping and/or other sources. Include onshore North Slope, offshore Beaufort, and TAPS pipelines.
2. Establish whether supporting information on pipeline segment characteristics (diameter, special protective measures, inspection measures, special spill detection measures, etc) can be obtained.
3. Develop a written plan for obtaining these data and placing them in a GIS database.

Phase II:

1. Implement the strategy developed in Phase I to obtain pipeline data.
2. Develop GIS database.

Methods

Phase I:

1. Establish potential data sources and develop communications links.
2. Establish inventory of data and data sources.
3. Establish contacts for all known data sources.
4. Establish cooperative agreements with major potential users of the data.
5. Provide written permission to access the data.
6. Develop written plan for obtaining data and constructing GIS database.

Phase II:

1. Implement strategy for obtaining data.
2. Implement strategy for constructing GIS database:
   a. Consistent with the MMS corporate database structure.
   b. Capable of point and click identification of specific pipeline segments and characteristics.
   c. Capable of display of existent pipeline by year.

Date Information Required: The final GIS database is due December 2005.

Revised date: September 2005

Region: Alaska

Planning Area: Beaufort Sea

Title: Determining Archaeological Potential of Buried Terrestrial Landforms in the Beaufort Sea: Phase I

MMS Information Needs to be Addressed: MMS permitting decisions for exploratory wells, development and production facilities and pipelines in the Beaufort Sea must include an assessment of the potential for prehistoric archaeological sites in the areas to be disturbed by the permitted activities. This information will be used for NEPA analysis and documentation for Beaufort Sea Lease Sales, DPP's, and pipeline rights-of-way in the Beaufort Sea Planning Area.

Actual Cost: (in thousands): **Period of Performance:** FY 2003-2006
FY 2003 $100
Actual Costs: $100

Conducting Organization: Northern Land Use Research, Inc.

Description:
Background The MMS is required under the National Historic Preservation Act to evaluate the potential effects of our permitted activities on significant archaeological resources. To fulfill this requirement, the MMS has developed an archaeological resources protection program that requires review of geological and geophysical data within OCS lease areas to identify specific locations having potential for preserved prehistoric archaeological site deposits. Existing terrestrial archaeological data indicate that relict landforms such as paleo-channels, stream terraces, point bar deposits, lakes, and lagoons dating from the last glacial advance/low sea stand (i.e. late Wisconsinan) are locations where preserved archaeological deposits are most likely to occur. Recent geophysical data collected from OCS lease areas in the Beaufort Sea indicate the presence of these types of relict landforms at and just beneath the seafloor shoreward of the 20-meter isobath where winter shorefast floating ice protects the seafloor from large pack ice incursions and ice gouging. There are presently insufficient data to evaluate whether these landforms date from the late Wisconsinan low sea stand (ca. 19,000 to 3,000 B.P.) in which case they would have potential for preserved archaeological deposits, or from an earlier period of low sea stand, in which case they would not have archaeological potential. If it can be established that these features date earlier than the late Wisconsinan, the MMS would no longer require prehistoric archaeological resource analyses and associated mitigation measures (i.e. avoidance of relict features or further investigation) for leases in the Beaufort Sea. Samples and age-dates obtained through this study may also be useful in refining the relative sea level history for the Beaufort and Chukchi Seas which, in turn, may contribute to our understanding of the causes and effects of past global climate changes.

Objectives The objective of this study is to evaluate whether the relict terrestrial landforms observed at, and just beneath the seafloor, in the Beaufort Sea date from the late Wisconsinan or from an earlier time period.

Methods This study is in three phases; however, the need for each subsequent phase of the study is dependent on the findings of the previous phase.

Phase I: Review of Existing Geologic and Geophysical Data and Analysis of Existing Cores

1. Perform thorough review of existing geologic and geophysical data contained in published studies and reports for the Beaufort Sea including reports and data from industry drill site and pipeline clearance surveys, and the data compiled in MMS-sponsored study released in 2002.
2. Map areas containing drowned terrestrial landforms using OCS Study MMS 2002-017, and establish whether cores were taken in these areas.
3. Find out if cores from these surveys still exist, where they are stored, their general condition, and how they may be acquired or sampled.
4. Acquire previously drilled cores or core samples from existing Beaufort Sea industry surveys and the 1979 USGS Beaufort Sea core program in areas identified as having potential drowned terrestrial landforms.
5. Conduct laboratory analysis of samples taken from the cores associated with terrestrial landforms to extract samples for
   a. Radiocarbon or other isotopic dating techniques.
   b. Paleoenvironmental analyses.
   c. Archaeological analyses, if macroscopic indicators of a site such as charcoal; charred vegetal material, bone or shell; or lithic material are present.
6. Use previously acquired industry surveys and relevant USGS high-resolution seismic survey data to identify areas of potential terrestrial landforms for which sediment cores do not exist.
7. If the existing data analyzed in the Phase I study are insufficient to categorically estimate the age of the terrestrial landforms identified in existing seismic data, outline the following for the Phase II study:
   a. Locations where additional high-resolution seismic lines are needed to correlate terrestrial features observed in existing seismic data.
   b. Locations where additional sediment cores are needed to evaluate terrestrial features seen in existing seismic data or where they are needed to otherwise validate seismic interpretations.

Phase II: Collection and Analysis of Additional Seismic Lines and Cores

1. Collect and analyze marine high-resolution seismic profiles along transects identified in the Phase I study.
2. Collect new cores in the areas identified in the Phase I study using:
   a. Vibracore and/or rotary drilling rig mounted in marine vessel or over-ice vehicle.
   b. Onboard core storage and preliminary analysis.
3. Conduct laboratory analysis of collected cores to extract samples for:

a. Radiocarbon or other isotopic dating techniques.
b. Paleoenvironmental analyses.
c. Archaeological analyses (if macroscopic indicators of a site such as charcoal; charred vegetal material, bone or shell; or lithic material are present).

4. Estimate the age of observed shallow offshore terrestrial landforms and, if data are adequate, establish a new relative late Wisconsinan sea level curve for the Beaufort Sea.

Phase III: Archaeological Baseline Study for the Beaufort Sea Area

If the Phase I or Phase II studies conclude that the shallow offshore terrestrial landforms in the Beaufort Sea date from the late Wisconsinan low sea stand, the Phase III Archaeological Baseline Study will be needed. The baseline study will synthesize all existing geologic, paleoenvironmental and archaeological data for the Beaufort Sea area to:

1. More clearly define the relationship of prehistoric human populations to the prehistoric landscape.
2. Define the size, type, and ages of sites to be anticipated in the offshore area.
3. Define how site densities fall off with increasing distance from the various types of landforms.

Date Information Required: A final report is due October 2005.

Date: September 2005

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ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDIES PLAN 2006

Region: Alaska

Planning Areas: All Alaska Planning Areas

Title: Minerals Management Service/University of Alaska-Fairbanks/State of Alaska/Coastal Marine Institute – Management

MMS Information Needs to be Addressed: By adopting this cooperative agreement, improved leasing decisions and EIS analyses pertinent to lease sales in the Beaufort Sea, Cook Inlet, Gulf of Alaska, and Chukchi Sea/Hope can be made. Final reports will be available for lease sales and post-sale decisions; interim data products and inputs will be used to address information needs. Topical areas to be addressed under the Coastal Marine Institute have been identified through this Annual Study Plan, previous Alaska Region study plans, and the Framework Issues. The study also will develop information that addresses public concerns raised during outreach efforts.

Actual Costs (in thousands): **Period of Performance:** FY 1998-2006

FY 1998	$101
FY 1999	$100
FY 2000	$112
FY 2001	$125
FY 2002	$125
FY 2003	$109
Total Cost:	$563

Conducting Organization: CMI, UAF

Description:

<u>*Background*</u> This study provides management of a large ongoing program of scientific research into framework issues related to lease sales identified in the MMS *Final Outer Continental Shelf Oil and Gas Leasing Program 2002-2007.* It is a cooperative program between MMS and the University of Alaska, with State of Alaska participation. The Coastal Marine Institute (CMI) is expected to leverage additional scientific results and logistics capability at levels comparable to the MMS contribution. The Coastal Marine Institute will update and expand our understanding of OCS environmental information and address future needs related to the offshore oil and gas program in Alaska.

<u>*Objectives*</u> The purpose of the CMI is to generate scientific information for MMS and State of Alaska decision makers that is consistent with the needs outlined by the Framework Issues. The Framework Issues are:

1. Scientific studies for better understanding marine, coastal or human environments affected or potentially affected by offshore oil and gas or other mineral exploration and extraction on the OCS.

2. Modeling studies of environmental, social, economic, or cultural processes related to OCS gas and oil activities in order to improve scientific predictive capabilities.
3. Experimental studies for better understanding of environmental processes, or the causes and effects of OCS activities.
4. Projects which design or establish mechanisms or protocols for sharing data or scientific information regarding marine or coastal resources or human activities in order to support prudent management of oil, gas and marine mineral resources.
5. Synthesis studies of scientific environmental or socioeconomic background information relevant to the OCS gas and oil program.

Methods A proposal process is initiated each year with a request for letters of intent to address one or more of the Framework Issues. The proposals are requested from university researchers and other scientific researchers in State agencies. A Technical Steering Committee made up of scientific representatives of the cooperators reviews letters of intent and proposals to be evaluated for possible funding. External peer reviews may be requested for new projects. Principal investigators give presentations at ITM's, scientific conferences, and various public meetings.

Date Information Required: Information products are required from 1 year to 6 months prior to proposed lease sales. Also, the information collected is required to be used in postlease decisions such as exploration plan reviews and approvals, and potential development-stage environmental impact analyses and related approvals, or in the implementation of lease-sale mitigating measures that require scientific information for implementation.

Revised date: September 2005

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDIES PLAN 2006

Region: Alaska

Planning Areas: All Alaska Planning Areas

Title: Management, Logistics, and Warehouse Storage of Oceanographic Equipment

MMS Information Needs to be Addressed: Without funding of this program-support element, it would not be possible to maintain or deploy the 36-foot MMS Launch 1273 that provides a mobile, cost-effective, and specialized research vessel for a variety of biological and oceanographic studies throughout the coastal waters of Alaska. Costs for certain studies would increase significantly if more expensive marine-support alternatives were chartered.

Additionally, it would not be possible to maintain an equipment warehouse that allows us to re-use and share equipment effectively among projects and agencies. This is a critical program-support element related to studies that support all current leases.

Actual Costs (in thousands):
FY 2005 $112
FY 2006 $112
FY 2007 $112
Total Cost: $251

Period of Performance: FY 2005-2007

Conducting Organization: GSA-administered lease for warehouse and MMS for Launch 1273, UAF, and other aspects

Description:
Background The MMS, Alaska OCS Region, has responsibility for equipment management in support of Alaska studies. In 1996 the General Services Administration (GSA) obtained a new storage facility for ESP use. The equipment is stored in a small warehouse in Anchorage, where it is maintained and made available for ongoing projects. This support element also provides funds for maintenance of the MMS Alaska Region Launch 1273, a small research vessel needed for various oceanographic studies, as well as funds for other equipment maintenance and shipping. Also under this project MMS will support Alaska ESP equipment management and other storage needs.

Objectives The purpose of this program-support element is to efficiently manage and store oceanographic equipment and provide other support to ESP needs

Methods The General Services Administration arranges for an appropriate warehouse facility for our use.

Launch 1273 was commissioned in 1983. MMS contractors will use it for the cANIMIDA, the study "Beaufort Sea Nearshore Currents" (FY 2005-07), and other oceanographic studies in the Arctic.

Current Status of Information: Not applicable.

Revised date: September 2005

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDIES PLAN 2006

Region: Alaska

Planning Areas: All Alaska Planning Areas

Title: Conference Management and Reports on MMS Results

MMS Information Needs to be Addressed: This study will help to resolve environmental and technical issues for MMS program managers and to increase public confidence in the data used by the OCS program. Workshops are needed for NEPA analysis and documentation for Beaufort Sea Lease Sales, Chukchi/Hope Basin Lease Sale if nominations are received, and DPP's. The need for the transfer of studies information is ongoing. The dates will be coordinated with lease sales.

Actual Cost (in thousands): **Period of Performance:** FY 2005-2007

FY 2005	$65
FY 2006	$100
FY 2007	$144
Total Cost:	$420

Conducting Organization: MBC Applied Environmental

Description:

<u>*Background*</u> As discussed in Section 1 Introduction-Background of this plan, the Alaska Environmental Studies Program (ESP) has organized many meetings on environmental studies information. During the past decade, the main priorities have been small workshops for resolution of environmental issues and Information Transfer Meetings (ITM's) for the exchange of studies information among Principal Investigators and the general public. In addition to the transfer of information through meetings, the ESP has transferred information through ITM proceedings, reports and publications on MMS results. The Alaska ESP has also organized small meetings on a limited range of topics called Information Update Meetings (IUM's). The Alaska ESP has also organized workshops with experts and interested parties on selected topics oriented to formulating concepts for a new study to address a study need.

<u>*Objectives*</u> The objectives are to produce ITM's, IUM's, small workshops, and publications on OCS environmental studies information.

<u>*Methods*</u> The primary method is to coordinate meetings and workshops and assist with preparation of publications. Coordination includes organizing appropriate speakers and participants and logistics. FY 2005 components will include:

1. Hold a technical design meeting on procedures for bird hazing and deterrent techniques in relation to potential oil spills.
2. Hold a Chukchi Sea Information Update Meeting scheduled for the fall of 2005.

3. Respond to future Task Orders for Information Transfer Meetings and Information Update Meetings.

Date Information Required: Final proceedings are due within 60 days after meetings and workshops have been held.

Revised date: September 2005

Section 2.2 Profiles of Studies Proposed for FY 2006

2.2 Profiles of Studies Proposed for FY 2006

Table 1. Alaska OCS Region Studies Proposed for the FY 2006 NSL

Page #	Discipline	Title
145	PO	Feasibility and Study Design for Boundary Oceanography of the Beaufort Sea
147	PO	Beaufort Sea Mesoscale Meteorology
149	PO	Mapping Sea Ice Overflood Using Remote Sensing from Smith Bay to Camden Bay
151	PO	High-Resolution Regional Bathymetry for Beaufort Sea Continental Shelf
153	BIO	Beaufort Sea Marine Fish Monitoring
155	BIO	Ecological and Oil Spill Implications of Colville and Mackenzie River Plumes
157	BIO	Arctic Cisco Genetics and Otolith Microchemistry
159	BIO	Invasive Species Workshop
PO = Physical Oceanography BIO = Biology		

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDIES PLAN FY 2006

Region: Alaska

Planning Area: Beaufort Sea

Title: Feasibility and Study Design for Boundary Oceanography of the Beaufort Sea

MMS Information Needs to be Addressed: This study is needed by MMS to better understand the oceanography of Beaufort Sea and to insure that first-order oceanic physics are understood and appropriately represented in MMS circulation models and oil spill risk analyses. This information will be used to evaluate oil spill contingency plans for Liberty, if approved, and other developments. It would also be used in NEPA analysis and documentation for proposed Beaufort Sea Lease Sales, EP's, and DPP's.

Period of Performance: FY 2006-2008

Description:
<u>*Background*</u> MMS sponsored two international workshops designed to provide MMS with recommendations regarding future Arctic oceanographic research needs. The first 2003 workshop included discussions of international sea ice modelers and observers who developed strategies to advance the state-of-art in Arctic ice modeling. Following recommendations from this workshop, MMS and NASA signed an IA in 2003 for the ongoing study *Sea-Ice Modeling in Nearshore Beaufort and Chukchi Sea in the Arctic Ocean*.

The second 2003 workshop included discussions of international experts in Arctic oceanography on state-of-knowledge of Beaufort Sea physical oceanography and recommend long-range goals for oceanographic research to meet MMS needs. Several of the workshop recommendations articulate the need to better understand the coastal boundary (buoyancy-forced coastal circulation), lateral ocean boundaries, and the offshore boundary. Two MMS studies started in 2003 are now ongoing. *Beaufort Sea Nearshore Currents*, an ADCP along coast mooring study, and *Mapping and Characterization of Recurring Spring Leads and Landfast Ice in the Beaufort Sea*, address a portion of these recommendations. However, other recommendations require more resources than MMS can provide alone. Thus, they are best suited for interagency, international partnerships.

<u>*Objectives*</u> Establish feasibility of partnerships that respond to those specific boundary issue recommendations in the BSW report. Provide MMS with design and costs for research study to meet those recommendations. These recommendations cover:

1. Lateral Ocean Boundaries: Develop better understanding of western and eastern boundary influences.
2. Offshore Boundary:

a. Conduct shipboard and moored measurements of currents, sea-ice drift, and hydrography across Beaufort Sea shelf.
b. Establish fate of Barrow Canyon outflow.
c. Establish the degree of infiltration of Mackenzie River plume into eastern Alaskan Beaufort Sea.

3. Buoyancy-forced Coastal Circulation:
   a. Gain better understanding of the processes which enhance or inhibit transport across the landfast/pack ice margin.
   b. Gain better understanding of the behavior of the snowmelt freshwater plumes beneath landfast ice in spring.
   c. Make better estimates of the freshwater discharge cycle for North Slope rivers.
   d. Make observations of open water period 3-D circulation and thermohaline field associated with river discharge.
   e. Develop geochemical discrimination techniques and apply to keying of low salinity to their freshwater sources.

Methods

1. Develop interagency contacts, agreements or contracts with other entities interested in cost or logistics sharing in these objectives. Prioritize specific objectives based on mutual interest and maximization of scientific gain.
2. Provide for consideration by MMS a study design and cost estimate for a Boundary Oceanography of the Beaufort Sea study that would obtain these objectives in a final report that MMS could consider for implementation in FY 2007 or 2008.
3. This project will consider results of FY05 workshop on hydrological modeling for freshwater discharge from the Alaska arctic coast, and coordinate with other ongoing environmental studies, as appropriate.

Date information is required: This information will be used to evaluate oil spill contingency plans for Liberty, if approved, and other developments. It would also be used in NEPA analysis and documentation for proposed Beaufort Sea Lease Sales, EP's, and DPP's. A final report will be due July 2008.

Revised Date: September 2005

Region: Alaska

Planning Area: Beaufort Sea

Title: Beaufort Sea Mesoscale Meteorology

MMS Information Needs to be Addressed: The final modeled data will improve the predictive capabilities of the MMS oil spill trajectory model and the SINTEF weathering model for the Beaufort Sea. Information will be used in NEPA analysis and documentation for Beaufort Sea Lease Sales, Exploration Plans (EP's), and Development and Production Plan (DPP's).

Period of Performance: FY 2006-2008

Description:
Background The 2003 MMS workshop on physical oceanography of the Beaufort Sea brought together international experts in Arctic oceanography to review the state-of-knowledge of Beaufort Sea processes and recommend long range goals for research to meet MMS needs. One recommendation was for improvements in understanding the mesoscale meteorology. Critical issues requiring study are the wind and surface stress fields established by mesoscale variations in regional meteorology and sea ice distribution and deformation fields. Accurate specification of the surface wind and stress field is essential to predicting ocean and ice circulation. The Beaufort Sea shelf is likely subject to substantial along and cross shore gradients in the surface wind velocity with these gradients possibly involving changes in both wind speed and direction. At present, wind gradients are not captured adequately by winds derived from synoptic pressure fields (typically prepared by weather forecasting and climate centers) and/or extrapolated from coastal meteorological stations, both of which are often used in estimating the shelf wind field. Oil spill models that rely on winds measured from coastal stations or from synoptic pressure fields could be seriously biased.

The MMS share shown above is 50 percent of the estimated total joint funding needed. Joint funding may be established via NOPP or IPY coordination.

Objectives Obtain data and build a new mesoscale meteorology model that can predict along shore and cross-shelf wind speed and direction for the Beaufort Sea, Alaska. The model will predict orographic steering effects of the winds from the Brooks Range and land and sea breeze affects due to changes in thermal gradients.

Methods

Phase I: Develop interagency agreements or contracts with other entities interested in cost or logistics sharing during these study efforts; collect and quantify existing data such as meteorological station data, landfast ice, pack ice, leads, surface currents from

CODAR, land cover and evaluate the need for additional Phase II data before implementation of any proposed model(s).

Phase II:

1. Collect additional data as required for model implementation based upon the analysis of Phase I data, model priorities, and cost:
   a. Improved sea ice measurements.
   b. Measurement of surface winds from portable, temporary meteorological stations, buoys, on the landfast ice, pack ice and other proposed meteorological stations on offshore islands or offshore oil platforms of opportunity.
   c. Spatially varying surface variables such as soil moisture, canopy temperature and water content, terrain height, land roughness, land percentage etc.
   d. Long range CODAR measurements.
   e. Other data.
2. Incorporate newly collected field data and develop preliminary model results that can predict the spatial and temporal variability of the along and cross shore surface wind and stress fields for the Beaufort Sea.

Phase III: Collect other data as necessary, compile with data from Phases I and II, and produce a mesoscale meteorological model.

Date information is required: Information will be used in NEPA analysis and documentation for Beaufort Sea Lease Sales, EP's, and DPP's. A Phase I report will be due in April 2007. Preliminary model results will be due in July 2008 and a final in July 2009.

Revised Date: September 2005

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDIES PLAN FY 2006

Region: Alaska

Planning Area: Beaufort Sea

Title: Mapping Sea Ice Overflood Using Remote Sensing from Smith Bay to Camden Bay

MMS Information Needs to be Addressed: This information is important to identify and characterize potential hazards, such as from strudel scar along the Beaufort Sea coast. In addition this information could be used to assist in the development of ice models and their performance during breakup in the landfast ice zone. The results will be used in NEPA analysis and documentation for Beaufort Sea Lease Sales, EP's, and DPP's.

Period of Performance: FY 2006-2009

Description:

Background MMS has limited spatial and temporal information on rivers overflooding the nearshore sea ice in spring. The most recent work in 1999 focuses on overflood of the Sagavanirktok River in the vicinity of the proposed Liberty prospect. There are also 3 years of overflood data for the Kuparuk River in the vicinity of Northstar. Landsat imagery from projects in 1988 and 1993 has been collected and archived at the University of Alaska Geophysical Institute for the Beaufort Sea. With the advent of development in the Beaufort Sea this type of information is needed to address issues regarding pipeline routing and facility siting. Analysis of overflood and its implications for exploration and development requires information on both the temporal and spatial distribution of ice overflood from the breakup of North Slope rivers in the spring. This study would provide baseline data and improve the accuracy of information for environmental assessment and hazard mitigation. These observations would also be of value to the offshore industry for planning operations on the OCS.

This study will provide information on the timing of river plumes in support of the MMS proposed study titled "Ecological and Oil-Spill Implications of Beaufort Sea River Plumes" and ongoing studies such as the "Beaufort Sea Nearshore Currents."

Objectives

1. Produce a time series depicting the spatial distribution of river water overflooding the landfast ice adjacent to the Beaufort Sea coast from Smith Bay to Camden Bay.
2. Quantify the relationship between stream flow and ice damming for the Sagavanirktok and Kuparuk rivers, and the aerial extent of overflooding on the landfast ice adjacent to those rivers.

Methods

1. Collect and synthesize existing Landsat/Radarsat remote sensing data.
2. Quantify the spatial and temporal distribution of river overflood of the moderate size rivers on the North Slope of Alaska from Smith Bay to Camden Bay. Focus on mapping the maximum overflood extent.
3. Compile Beaufort Sea stream gauge data.
4. Fly an aerial survey for one season to ground truth remote sensing data and quantify uncertainties of estimating the overflood from remotely sensed data.
5. Collect hydrographic data for the Sagavanirktok and Kuparuk rivers and quantify any relationship between river runoff and aerial extent of overflood.
6. Create a geographic information system map summarizing the spatial distribution of river overflood by year along the Beaufort Sea Coast. Provide individual years as well as minimum and maximum historical overflood extent.

Date information is required: In addition this information could be used to assist in the development of ice models and their performance during breakup in the landfast ice zone. The results will be used in NEPA analysis and documentation for Beaufort Sea Lease Sales, EP's, and DPP's. Draft information will be due December 2006. Draft and final reports with GIS maps will be due July and September 2007, respectively.

Revised Date: September 2005

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDIES PLAN FY 2006

Region: Alaska

Planning Area: Beaufort Sea

Title: High-Resolution Regional Bathymetry for Beaufort Sea Continental Shelf

MMS Information Needs to be Addressed: MMS will use this information for NEPA analysis and documentation for Beaufort Sea Lease Sales, EP's, DPP's, and pipeline rights of way in the Beaufort Sea Planning Area. Results will be important inputs to other ongoing research and analysis.

Period of Performance: FY 2006-2008

Description:
Background High-resolution regional bathymetric survey data in digital format are required for MMS mapping, analysis, and modeling purposes over the Beaufort Sea Shelf covering the area from the Barrow Canyon, just north of Barrow, east to Camden Bay. The lack of accurate, high resolution bathymetric data on a regional scale affects our ability to interpret the habitats of invertebrates, fish and marine mammals. Better bathymetry can assist scientists in the study of ice gouges and strudel scour and obtain better information for the modeling of oil spill trajectories, model oil in ice, locate potential archeological sites and assist current MMS studies to position oceanographic instruments. The acquisition of high resolution bathymetric data will provide maps charts and interpretive results that would be beneficial to biologists, oceanographers, geologists, archaeologist and managers in multiple agencies (MMS, NOAA, NMFS, USGS/BRD, and CMI), and would significantly improve the accuracy of our data analysis and model results for the Beaufort Sea.

The bathymetric surveys within the Beaufort Sea over the past 30 years are widely scattered and have a wide range of navigational and depth accuracies (MMS-OCS Report 2002-017). The best available regional bathymetry coverage's are 10 meter contour intervals. Regional bathymetry surveys done by NOAA in 1954 in the Beaufort Sea prior to Global Positioning Systems (GPS) may be adequate for shallow waters, but are of unknown precision. Some hydrographic surveys done by industry, federal government and research institutions are not currently available to MMS. Two MMS-sponsored workshops held in 2003 both emphasized that better, detailed bathymetry was a necessary precondition to both understanding and successfully modeling nearshore Beaufort Sea circulation and ice regime.

The MMS cost share shown is 50 percent of the estimated total joint funding needed. Joint funding may be established via NOPP or IPY coordination.

Objectives The primary objective will be to produce a high-resolution regional Beaufort Sea continental shelf bathymetric database for the purpose of assisting MMS and other researchers in interpreting physical and chemical oceanographic conditions, potential archaeological sites, and improve the output of our oil spill and ice model studies.

Methods

Phase I:

1. Aggregate available bathymetry for the Beaufort Sea in digital format. Develop a bibliographic database. Aggregate data from industry, research projects such as SCICEX, NSF Office of Polar Programs, and vessels of opportunity.
2. Display the data and verify its precision against other known data sets. For example NOAA 1954 data against Liberty bathymetry data collected by BPXA.
3. Propose bathymetric and side-scan sonar surveys over the Beaufort Sea continental shelf where data needs exist for the mapping of ice gouges, major channels, shoals, boulder patch, and potential archaeological sites and improve research in the development of oil spill trajectories and ice modeling.
4. Seek cost-sharing partners.

Phase II: (Two Years)

1. Implement proposed bathymetric and side scan surveys to map bathymetry of selected areas of the Beaufort Sea.
2. Produce a final digital database.

Date information is required: MMS will use this information for NEPA analysis and documentation for Beaufort Sea Lease Sales, EP's, DPP's, and pipeline rights of way in the Beaufort Sea Planning Area. The digital database and Phase I report will be due March 2007. The Phase II digital database and final report will be due September 2009.

Revised Date: September 2005

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDIES PLAN FY 2006

Region: Alaska

Planning Area: Beaufort Sea

Title: Beaufort Sea Marine Fish Monitoring

MMS Information Needs to be Addressed: Fish resources are important in the Beaufort Sea ecosystem and to the coastal communities. Study information will be used in NEPA analysis and documentation for Beaufort Sea Lease Sales, EP's, and DPP's.

Period of Performance: FY 2006-2009

Description:
Background A consistent Beaufort Sea fish monitoring study is needed to obtain fundamental and current fish resource information. Data at the most basic level, e.g., fish distribution data, are not only spotty but also outdated. Fish assemblages and populations in other marine ecosystems off Alaska have undergone observable regime-shifts in diversity and abundance over the last 20-30 years. While the same is likely true of the Beaufort Sea, it is unconfirmed because the scant distribution and abundance data available are pre regime-shift. Furthermore, the delineation of important marine mating, spawning, rearing, feeding and migration habitats (pre or post regime-shift), is simply non-existent.

In addition to the need for basic distribution data, ecological information is necessary to assess potential effects of offshore development. However, Beaufort Sea life history strategies, foraging, population dynamics and other aspects of marine fish behavior and ecology are, for the most part, unknown. Because MMS is the principle agency proposing federal actions in the Alaskan Beaufort Sea, it is unlikely that other sources of applicable information will become available.

This study will begin to establish baseline knowledge of fish distribution in the Beaufort leasing area and assess interannual variation through monitoring. Concurrent collection of salinity, temperature and plankton data can establish basic ecological facts.

Objectives

1. Design a long-term fish monitoring plan for the Beaufort Sea OCS leasing area that includes ocean and lower trophic data essential to understanding fish dynamics.
2. Implement the first survey covering $1/5^{th}$ of the Beaufort Sea OCS (roughly a 40 by 130 mile area). Repeat at the appropriate interval in the remaining areas of the Beaufort Sea OCS to establish a long term monitoring baseline.

Methods

Phase I: Design
Review and adapt marine fish survey design methods to specific MMS information needs and Beaufort Sea conditions. Design survey methods for long-term comparability, cost-effectiveness and incorporation of future technological and remote sensing advances. Monitor demersal and pelagic fishes at all life history stages and across depths and habitats. Include active *in situ* fish sampling with concurrent collection of plankton and ocean conditions.

Phase II: Implementation
1. Conduct the first survey based on results of the design phase. Analyze samples for basic ecological information. Summarize information on fish distribution, relative abundance, locations of critical or sensitive life history stage habitats, and trophic structure in GIS and report format. Provide intermediate results for NEPA analyses. Incorporate lessons learned into recommendations for the next 5-year survey in another section of the Beaufort Sea OCS.
2. Archive environmental data and specimens to provide a cost effective means of future hypothesis testing by MMS and other agencies.

Date information is required: Study products will be timed to enhance assimilation into environmental assessment and NEPA process of the Alaska OCS Region. Study information will be used in NEPA analysis and documentation for Beaufort Sea Lease Sales, EP's, and DPP's. The survey design will be due July 2007. Initial survey will be implemented in 2008. Initial survey results will be due July 2009. Draft and final reports are due October and December 2009, respectively.

Revised Date: September 2005

Region: Alaska

Planning Area: Beaufort Sea

Title: Ecological and Oil Spill Implications of Colville and Mackenzie River Plumes

MMS Information Needs to be Addressed: Understanding nutrient and chlorophyll characteristics of river plumes will improve predictability of location and productivity at all trophic levels. Understanding the physical characteristics of river plumes will improve our ability to predict transport processes near the biologically productive river mouths of the Beaufort Sea. This information will be used in NEPA analysis and documentation for Beaufort Lease Sales in 2007, 2009 and 2011, EP's and DPP's.

Period of Performance: 2006-2007

Description:
Background River mouths are dynamic and biologically productive. The Colville and Mackenzie River plumes strongly influence Beaufort Sea oceanographic conditions and primary productivity, exerting cascading effects on the distribution and abundance of zooplankton, fish, bird and marine mammal populations. Little data are available to define plume characteristics. Verified assumptions about river plume relationships to primary and secondary productivity can improve assessments of potential effects of oil and gas development on wildlife. Furthermore, the transport models do not incorporate river plume and sediment dynamics.

Beaufort Sea productivity may also fluctuate with changes in sea ice cover, nutrient runoff from land, coastal erosion processes, and turbulence mediated by the river plumes. Documentation of variability and changes of baseline conditions, due to these factors, is necessary to eliminate oil and gas development as the cause of possible negative effects.

Recent advances in satellite imagery, such as the SeaWiFS (Sea-viewing Wide Field-of-view Sensor) launched in 1997 and MODIS (Moderate Resolution Imaging Spectroradiometer), make possible a more rapid and inexpensive measure of primary productivity fluctuations and sediment content both seasonally and year to year. Canadian agencies would be approached to collect field data in the Mackenzie River.

The MMS share shown above is 50 percent of the estimated total joint funding needed. Joint funding maybe established via NOPP or IPY coordination.

Objectives

1. Develop and test SeaWiFS algorithms for Beaufort sediment-laden river plumes.

2. Test the hypothesis that river plume characteristics influence patterns of primary and secondary productivity in the Beaufort Sea.
3. Evaluate how the interannual variability of the river plumes affects productivity and transport processes.

Methods

1. Develop initial algorithms to evaluate primary productivity in turbid coastal waters of the Beaufort Sea. Compare existing SeaWiFs and MODIS satellite data to existing *in situ* measures (e.g., from ANIMIDA and the proposed Sea Ice Overflood Mapping) of chlorophyll, colored dissolved organic matter, suspended sediments, ice, salinity, and temperature. Refine initial algorithms using SeaWiFS and MODIS images synchronous with new measures from ships and drifters. Coordinate with Canadian study efforts for potential synchronous measures of the Mackenzie River plume.
2. Estimate variability of the plume characteristics over seasonal, annual, and Arctic weather cycles. Assess the relationship to coincident changes in sea ice cover, nutrient runoff from land, coastal erosion processes, and turbulence.
3. Infer ecological implications of river plume characteristics to upper trophic levels and present general research recommendations relevant to off shore oil and gas development.

Date information is required: This information will be used in NEPA analysis and documentation for Beaufort Lease Sales, EP's and DPP's. An annual report based on preliminary algorithms will be due December 2007. The final results will be due December 2008.

Revised Date: September 2005

Region: Alaska

Planning Area: Beaufort Sea

Title: Arctic Cisco Genetics and Otolith Microchemistry

MMS Information Needs to be Addressed: Arctic cisco are an important subsistence resource and potentially affected by oil and gas development in the Beaufort Sea ecosystem. Information from this study will be used in NEPA analysis and documentation for Beaufort Sea Lease Sales, EP's, and DPP's.

Period of Performance: Phase I: FY2006; Phase II: FY2007-2009

Description:
Background Fall fishing under the ice of the Colville River for Arctic cisco is considered an important part of Inupiat culture and a vital subsistence harvest for Nuiqsut villagers. Other villages also depend on Nuiqsut residents for a supply of Arctic cisco. Native residents are concerned that Arctic cisco in the Colville River are less abundant than in the years preceding oil and gas development.

A 2003 MMS-sponsored Arctic cisco workshop recommended genetic and microchemistry studies as a cost-effective means to assess the degree of isolation of the Colville River Arctic cisco stock. The more isolated it is, the more vulnerable this major subsistence resource is to effects of development and human activities in Alaska. A microchemistry study of an existing 15-year collection of otoliths would verify whether larva feed during the 400+ mile migration from the Mackenzie River in Canada to the Colville River in Alaska. Otolith microchemistry will also assess whether the wide variation in the Arctic cisco subsistence catch correlates with nutritional variation. Understanding this relationship may separate potential natural and development influences and help predict future catches of this critical subsistence resource.

Participants in a 2003 MMS sponsored Arctic cisco workshop recommended genetic and microchemistry studies as a cost-effective means to address critical Arctic cisco questions and issues. The genetic study will address how geographically isolated—and therefore how vulnerable—this major subsistence resource is to effects of development and human activities in Alaska. The microchemistry study of an existing 15-year collection of otoliths will verify whether larva feed during the 400+ mile migration from the Mackenzie River in Canada to the Colville River in Alaska. Otolith microchemistry may also determine whether variations in population levels are correlated with changes in food sources in a way that helps explain the wide variation in the Arctic cisco catch in the subsistence fishery and helps predict future catches of this critical subsistence resource.

Objectives Test the hypotheses that:

1. The Colville River Arctic cisco population does not include fish spawning in other than the Peel and Red River tributaries of the Mackenzie.
2. Peel/Red River spawning stock does not include fish that rear in locations other than the Colville River.
3. Colville River Arctic cisco abundance is correlated with changes in marine residence and growth at various life stages.

Methods

Phase I: Pilot study

1. Review genetic and otolith studies of Arctic cisco in the Mackenzie River, other parts of Canada, and in Russia. Coordinate with ongoing MMS sponsored analysis of existing Colville River Arctic cisco data.
2. Obtain Colville River cisco genetic samples from Nuiqsut residents, otoliths, genetic and otolith samples through Canada DFO, Inuit Joint Secretariat and local residents of Tuktoyuktuk Harbor, Canada.
3. Assess feasibility and design for Extended Study.

Phase II: Extended Study

1. Obtain genetic samples over 2 years to follow up previous genetic evidence that the Colville River Arctic cisco population may include a small segment from source stocks other than the Peel and Red Rivers.
2. Examine genetic evidence from eastern population locations to estimate whether fish from other locations may also spawn in the Peel and Red Rivers.
3. Measure variability in otolith microchemistry and its correlation to changes in abundance.
4. Evaluate the implications of the genetic and otolith evidence on the variation in abundance of and vulnerability of Colville River Arctic cisco.

Date information is required: Information from this study will be used in NEPA analysis and documentation for Beaufort Sea Lease Sales, EP's, and DPP's. Annual reports will be due July 2008 and 2009. A draft final report will be due July 2010 and the final report will be due September 2010.

Revised Date: September 2005

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDIES PLAN FY 2006

Region: Alaska

Planning Areas: All Planning Areas of Alaska

Title: Invasive Species Workshop

MMS Information Needs to be Addressed: The workshop will inform MMS analysts of high latitude biological invasive species, pathways, and mitigations for use in complying with Executive Order #13112, the Magnuson-Stevens Act (e.g., Essential Fish Habitat). It will also (a) aid management in decision-making and formulating mitigation measures and (b) provide information for use in NEPA analysis and documentation for Beaufort Sea Lease Sales, EP's, and DPP's.

Period of Performance: FY 2006-2007

Description:
Background Invasive species are estimated to be second only to habitat alteration as a factor in the endangerment and extinction of native aquatic species. Invasive species are often considered a major threat to ecosystems. Invasive species may also adversely affect Essential Fish Habitat of fish species managed under the Magnuson-Stevens Act. Shipping is known as a means of transferring aquatic organisms on a global scale. Studies have documented the role of ballast water and hull fouling as major vectors for these transfers to new areas. Offshore exploration and production structures and vessels must be brought to Alaska via the sea. Non-native organisms settled on these vessels and structures could be transplanted to Alaska.

The Alaska OCS Region needs information identifying high latitude biological invasive species, pathways, and mitigations to comply with Executive Order #13112. This Executive Order requires that all Federal agencies "prevent the introduction of invasive species; detect and respond rapidly …; monitor invasive species populations accurately and reliably." Section 2(a)(3) specifically requires that agencies shall "not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere …"

The MMS share shown above is 60 percent of the estimated total joint funding needed. The U.S. Fish and Wildlife Service, ADF&G Invasive Species Program, Cook Inlet Regional Citizens' Advisory Council, Prince William Sound Regional Citizens' Advisory Council, and the Aquatic Bioinvasion Research & Policy Institute have all expressed interest in collaborating on an invasive species workshop.

Objectives

1. Identify existing information sources and expertise on (a) high latitude biological invasions, particularly in marine waters, and (b) OCS exploration and production (e.g., structures and vessels) as vectors for the transfer of invasive species.
2. Identify and assess pathways for invasive species transfer associated with OCS exploration and development in Alaska, and the potential impacts of such transfers.
3. Identify and assess effective means to mitigate impacts identified in #2 above.

Methods

1. MMS will conduct a local intergovernmental/industry meeting to evaluate potential involvement in or co-sponsorship of the study before drafting detailed technical specifications.
2. Review and assess the potential OCS operations links to potential transfers of invasive species.
3. Summarize potential impacts associated with OCS-related invasive species transfers.
4. Develop recommendations for priority mitigation measures to minimize such impacts.
5. Identify data deficiencies for potential future research.

Date information is required: This study will provide information for use in NEPA analysis and documentation for Beaufort Sea Lease Sales, EP's, and DPP's. Draft and final reports, due October and December 2007, will be available for the 2009 and 2011 lease sales and for exploration and development plan EA's on existing leases.

Revised Date: September 2005

Section 2.3 Profiles of Studies Proposed for FY 2007 NSL

Table 2. Alaska OCS Region Studies Proposed for the FY 2007 NSL

Page #	Discipline	Title
163	FE	Worst-Case Blowout Occurrence Estimators for the Alaska OCS
165	BIO	Arctic Cod Distributions, Habitats, and Influence on the Beaufort Sea Ecology
167	BIO	Arctic Fish Ecology Catalogue
169	BIO	Development of a Long-duration Implantable GPS Transmitter for Sea Ducks
171	PS	Joint Funding Opportunities in Existing Marine Bird or Marine Mammal Studies
173	SE	Socioeconomic Book—Phase II
175	MD	Verification of Biological Construction Effects of Northstar Pipeline on the Benthic Community and Temperatures
177	MD	Chukchi Offshore Monitoring in Drilling Area (COMIDA)
179	OT	Mapping of Ice Gouge and Strudel Scour Density for the Beaufort Sea Utilizing Existing Data

FE = Fates & Effects
BIO = Biology
PS = Protected Species
SE = Social Science and Economics
MD = Multi-disciplinary
OT = Other

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ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDIES PLAN FY 2006

Region: Alaska

Planning Areas: Beaufort Sea, Chukchi Sea, Hope Basin, Cook Inlet

Title: Worst-Case Blowout Occurrence Estimators for the Alaska OCS

MMS Information Needs to be Addressed: The Oil-Spill-Risk Analysis (OSRA) is a cornerstone to regional EIS's environmental assessments, and oil-spill-contingency planning. Oil-spill issues constitute a significant portion of public comments submitted on sale or development EIS's in the Alaska OCS Region. Information from this study will be used in NEPA analysis and documentation for Beaufort Sea, Chukchi/Hope Basin, and Cook Inlet Lease Sales, EP's, DPP's, and in reviewing oil-spill-contingency plans.

Period of Performance: FY 2007-2009

Description:

Background The MMS has used the historical spill record on the OCS primarily as an indicator of future spill occurrence rates on the OCS. These data are supplemented in other ways, for example by engineering and fault tree studies of spill risk. Often as part of environmental assessments, MMS is tasked with providing analysis and probability of what at varying times has been known as a worst case, catastrophic case, large-spill case, or very-large-low-probability case spill. These low-probability statistics cannot be provided by MMS Field Operations or Resource Evaluation offices. In response to this issue, the MMS Technology Assessment and Research Program initiated a study in 2000 to estimate worst case pipeline spills, primarily for the Gulf of Mexico, and considered, but was unable to extend that study to cover blowouts. The study described here will similarly evaluate the probabilities of occurrence of blowouts larger than have ever occurred on the U.S. OCS.

Objectives

1. Derive statistical/engineering procedures to extrapolate occurrence rates for worst case OCS oil blowouts.
2. Develop model/algorithm that would allow desktop PC estimation of blowout size given a probability of occurrence and the probably of occurrence for a given blowout size.

Methods

1. Review existing worst-case blowout examples (probability, size, and basis) from regional (Alaska) oil spill contingency plans and environmental assessments.
2. Evaluate applicability of alternate approaches against data needs and availability for each approach, considering:
   a. Geological formation constraints.

   b. Environmental and geological hazards specific to individual planning areas and more local hazards that may affect size or likelihood of blowouts.
   c. Potential effect of engineering design on size or likelihood of worst case blowouts.
3. Develop a model that provides blowout size or probability of occurrence, given the other parameter, for very large or worst case blowouts.
4. Coordinate this study with the MMS Technology Assessment and Research Program related studies.

Date information is required: Information from this study will be used in NEPA analysis and documentation for Beaufort Sea, Chukchi/Hope Basin, and Cook Inlet Lease Sales, EP's, DPP's, and in reviewing oil-spill-contingency plans. An interim report will be due December 2008. A draft and final report will be due October and December 2009, respectively.

Revised Date: September 2005

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDIES PLAN FY 2006

Region: Alaska

Planning Area: Beaufort Sea

Title: Arctic Cod Distribution, Habitats and Influence on Beaufort Sea Ecology

MMS Information Needs to be Addressed: This information will improve understanding of a key species and thus all trophic levels. Information will be used for NEPA analysis documents for Beaufort Sea Lease Sales, EP's, and DPP's.

Period of Performance: FY 2007-2011

Description:
Background Arctic cod are thought to be the most significant consumer of primary production in the Beaufort Sea and the most significant food source to higher trophic levels. Marine mammals such as seals, whales and walruses; seabirds such as terns, gulls, murres, and kittiwakes; fishes such as fourhorn sculpin and Arctic char all feed on arctic cod. Polar bears and possibly walrus in turn feed on ringed seals, spotted seals and some bearded seals. Thus Arctic cod influence the distribution and ecology of their predators.

Yet knowledge of Arctic cod spatial and seasonal distribution is limited. In the Beaufort Sea, Arctic cod of all ages have been documented from inshore to175 km offshore in a few to 400 meters depths. Temperature and salinity preferences and spawning locations are largely unknown. They are found singly and in large schools but there is no coherent understanding of when or where. Scientists speculate that in the Beaufort Sea spawning could be up to 6 months later than in other locations.

Previous MMS sponsored fish studies focused primarily on the lagoons and bays (primarily Simpson Lagoon and a few in Camden Bay) and nearshore, brackish waters less than10 km out, missing most of the suspected Arctic cod locations.

Objectives

1. Compile existing Arctic cod information and archived specimens.
2. Implement a seasonal and synoptic survey.
3. Synthesize Arctic cod distribution and life history patterns and its role in the trophic structure of the Beaufort Sea.

Methods

Phase I:
1. Review published and gray literature to develop a synthesis report and searchable annotated electronic bibliography of Arctic cod. Rate comprehensiveness of

ecological understanding by fish species or guild by developing matrices including biological information such as species, life stage, habitat use, temperature, salinity and relevant sampling information such as sampling gear, gear selectivity and data quality ratings.
2. Compile existing data; obtain and analyze existing archived biological samples and data; and perform a detailed comparative and statistical analysis.
3. Hold workshop with oceanography and fisheries scientists to develop working hypotheses, develop recommendations and identify joint agency funding.

Phase II:
1. Refine working hypotheses and develop synoptic geographic and seasonal sampling strategy. Coordinate with other offshore research conducted in the region to gather new data on Arctic cod and related oceanographic information in an efficient manner.
2. Integrate findings and report hypothesis testing results from an ecological perspective.

Date information is required: Information will be used for NEPA analysis documents for Beaufort Sea Lease Sales, EP's, and DPP's. The bibliography, ecological matrices, and synthesis reports for Phase I will be due July 2009. Data compilation and report of new results will be due July 2010. Workshop Proceedings will be due December 2010. Draft and final reports for Phase II will be due October and December 2011, respectively.

Revised Date: September 2005

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDIES PLAN FY 2006

Region: Alaska

Planning Areas: Beaufort Sea, Chukchi Sea, Hope Basin

Title: Arctic Fish Ecology Catalogue

MMS Information Needs to be Addressed: MMS needs organized fish ecology and behavior information for Arctic Alaska for environmental impact assessments and informed decision-making pertaining to leasing activity in Arctic Alaska. This information is needed in NEPA analysis and documentation for Beaufort Sea Lease Sales, EP's, and DPP's.

Period of Performance: FY 2007-2008

Description:

Background A comprehensive synthesis of ecological and behavioral information concerning arctic fishes of Alaska and adjacent countries (Russia and Canada) is critical to fisheries scientists investigating arctic fish resources of Alaska. MMS co-funded *Fishes of Alaska*, the most current inventory of fishes occurring in Alaska. However, the reference is only an inventory and taxonomic key to Alaska fish species. A companion volume describing the ecology and behavior of each fish species occurring in Alaska has yet to be funded. Limited ecological data on subarctic commercial and forage fish are available in gray literature, e.g., the National Marine Fisheries Service groundfish assessment documents for Gulf of Alaska, the Bering Sea and Aleutian Islands. Arctic fish ecological and behavioral information has not been synthesized; it is only available piecemeal from a wide range of peer-reviewed and gray literature.

Objectives

1. Synthesize ecological and behavioral information on Arctic Alaska fish.
2. Organize distribution, abundance, and habitat use information into a GIS format.
3. Publish as a web-based catalogue and GIS mapping function for agencies and public use.

Methods

1. The MMS will conduct an intergovernmental/academic/industry coordination meeting to evaluate potential co-sponsorship before seeking final approval.
2. Conduct an extensive and thorough review of the peer-reviewed and gray literature concerning each fish species that may occur or expand into Arctic Alaska waters. Include freshwater, diadromous, and marine fish species occurring in arctic waters of Alaska (Beaufort Sea, Chukchi Sea, Hope Basin) or adjacent arctic waters (eastern Russia and western Canada).

3. Synthesize ecological and behavioral information into a web-based catalogue.
    a. The first portion of the catalogue will include species-specific accounts of 1-3 pages in length per species. Pertinent information per each species include: species binomen; synonymy; common names; illustration; field marks; diagnostic features; geographical distribution (including GIS maps of documented occurrences and habitat areas by life history stage); biology (e.g. reproductive biology); behavior, ecology, and habitat (e.g. life history strategy, habitat types and areas, migration); size; interest to fisheries; literature; and remarks. Identify data deficiencies and areas for future research for each species.
    b. The second portion of the catalogue will include articles synthesizing ecological and behavioral information by topic. Topics include, but are not limited to: environmental and organismic constraints, foraging and feeding ecology, bioenergetics, use of time and space, growth, reproduction, predation and parasitism, competition and mutualism, dynamics of population abundance and production, life history strategies, fish assemblages, data deficiencies, and areas for future research. A species-specific approach is <u>not</u> desired for this section.
4. Publish and maintain as a web-based catalogue available to fisheries scientists and the greater public to use in research and education. The web-based catalogue is superior to a book because it may be updated with new information as it is published in the scientific literature, and is searchable using GIS functions.

Date information is required: This information is needed in NEPA analysis and documentation for Beaufort Sea Lease Sales, EP's, and DPP's. Draft and final reports will be due October and December 2008.

Revised Date: September 2005

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDIES PLAN FY 2006

Region: Alaska

Planning Areas: Beaufort Sea, Chukchi Sea, Hope Basin, Cook Inlet

Title: Development of a Long-duration Implantable GPS Transmitter for Sea Ducks

MMS Information Needs to be Addressed: If successful, such a development would revolutionize our ability to monitor individuals over a large spatial and temporal scale encompassing important events in the annual (and potentially encompassing the life-span of an individual) life-cycle of the species. For protected species such as the Steller's and Spectacled Eider (*Somateria fischeri*), information gained from applied research would allow researchers and managers alike to address some critical issues related to population definition/delineation. Such information would further elucidate assumptions inherent in the NEPA process and ESA assessments for future and proposed Cook Inlet and Arctic Lease Sales.

Period of Performance: FY 2007-2012

Description:
Background In general, our knowledge of basic sea duck life-history, ecology, and population demography is incomplete compared to other groups of waterfowl, according to 1999 and 2003 studies. Recent advances in radio-telemetry technology (i.e., lightweight implantable satellite transmitters), has allowed researchers to address questions related to population demography, according to a 2002 study, and movements of sea ducks at a relatively large spatial scale, according to a 1999 study. However, transmitter-life continues to limit our ability to address biologically relevant issues over a longer temporal scale according to a 1999 study. The development of a long duration implantable transmitter for use on sea ducks would prove invaluable in addressing questions concerning population demography for a number of species. In addition, deployment of long duration transmitters would allow researchers to broaden our understanding of species' life-history such as breeding-site fidelity, breeding propensity, questions related to periodic non-nesting, influence of environmental perturbations (e.g., El Niño effects), and potential effects of offshore oil and gas development. To date, most telemetry studies of sea ducks though informative have captured a relatively small "snapshot in time", thus limiting inferences. Additional advantages include an increased amount of information obtained per marked individual (data obtained during an entire annual "cycle") reducing the need to mark large numbers of individuals to achieve a given level of precision or resolution.

Long-term marking studies could have major implications for conservation and management for species currently protected under provisions of the Endangered Species Act (1973; hereafter ESA). For example, the Pacific population of Steller's Eider (*Polysticta stelleri*; STEI) winters primarily from the Kodiak Archipelago west along the

Alaskan Peninsula and the eastern Aleutian Islands, with smaller numbers wintering in the Gulf of Alaska, according to two USFWS studies in 1999 and 2002. The wintering flock represents a mixture of individuals from breeding areas in Russia and Alaska. Information on various aspects of population definition/delineation, population size and trends, population dynamics, and population ecology rank as high priorities for this species, according to a 2001 study, and will aid in its recovery in Alaska according to a USFWS 2002 study. Thus, research, design, and development of a long-duration implantable transmitter would go a long way towards addressing conservation issues for this species. Currently, it is difficult to obtain the appropriate permits to conduct this sort of research on STEI due to their status under the ESA and concern over potential mortality of individuals.

Objectives Develop and field test a long duration (>5 yr. "battery life") implantable satellite (GPS) transmitter to be used in sea duck research.

Methods

1. MMS will hold an intergovernmental/industry coordination meeting to evaluate potential involvement or co-sponsorship and feasibility prior to drafting detailed technical specifications.
2. Research and development (1-2 years) of a long duration implantable satellite transmitter (GPS) including "test" implants into and monitoring of similar diving duck species; captive study.
3. Field application of transmitters to similar sea duck species in the field (3-5 years). A small number (n = 10) of transmitters could be implanted as part of an existing long-term sea duck monitoring study.

Date information is required: Study results will be used in the NEPA process and ESA assessments for future and proposed Cook Inlet and Arctic Lease Sales. Annual reports will be due December 2007, 2008, 2009, 2010, and 2011. A draft and final report will be due January and March 2012, respectively.

Revised Date: September 2005

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDIES PLAN FY 2006

Region: Alaska

Planning Areas: All

Title: Joint Funding Opportunities in Existing Marine Bird or Marine Mammal Studies

MMS Information Needs to be Addressed: Data produced by such study tasks potentially would supply MMS with information needed to address issues that result from late-breaking legal, regulatory or political developments that were nonexistent or unanticipated during the preparation of the relevant MMS Annual Study Plan. Acquisition of issue-specific information in many cases would allow MMS to effectively resolve differing opinions with other agencies without protracted discussion.

Period of Performance: FY 2007-2010

Description:
Background The MMS periodically learns about relatively short-term, partnership opportunities on existing marine bird or marine mammal studies initiated or underway by other agencies. Such proposals range from funding specific aspects of existing studies that are perceived to be of interest to MMS to funding specific products that would be used by MMS analysts. Some of these items address MMS issues and needs or would provide data of use to MMS in GIS and other analyses or data that is considered too narrow in scope to warrant a fully developed/funded MMS study.

Objectives Establish a mechanism to enter into joint funding arrangements with other agencies to facilitate the acquisition of needed, small-scale scientific information and/or scientific data.

Methods Joint funding agreements would be arranged through Inter-agency Agreements or Purchase Orders indicating the specific data collection that is proposed for funding by MMS, products that would be delivered (reports, journal articles, digital data), and the agreed funding level. MMS would potentially cost-share up to 25 percent of the total project cost(s).

Date information is required: Study results will be used in the NEPA process and ESA assessments for future and proposed Cook Inlet and Arctic Lease Sales. This has no due date, but we recommend the information that would result from funded tasks be available prior to initiation of EIS or other processes associated with future leasing/production in the relevant planning area.

Revised Date: September 2005

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ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDIES PLAN FY 2006

Region: Alaska

Planning Areas: All

Title: Socioeconomic Book-Phase II

MMS Information Needs to be Addressed: The proposed project will amplify the current book project to achieve further utility to the general public. The results of the study will be used in NEPA analysis and documentation for lease sales in all Alaska Planning areas, EP's, and DPP's.

Period of Performance: FY 2007-2010

Description:

Background MMS has previously contracted to create a peer-reviewed book that would synthesize selected Alaska social and economic research findings. Although the peer-reviewed book synthesis project is not complete, its final shape and contour are sufficiently established to recognize that its technical level may not appeal to all potential audiences. In particular, a second book can be imagined that would deliver a comparable synthesis to an entirely different target audience. A second book – one with more limited but more focused scope that might supplement and expand upon the momentum of the first book – could be produced that would explicitly target Alaskan coastal communities and the broader reading public. It would broadly synthesize the history of social and economic research in Alaska with specific regard to implications for these communities as potentially affected by OCS activities. The project would attempt to produce an end product that would be suitable for curriculum in high schools and colleges across the state. The second book would be different from the first in multiple ways, including length, readability, topical focus, cultural orientations, and classroom utility. Also, the project will not require the large assortment of multiple authors, editors, and reviewers that have extended the life of the original project.

Objectives

1. Produce a book that will broadly capture the recent synthesis of social research in Alaska with the explicit goal to target Alaskan coastal communities and the lay public.
2. Develop MMS collaboration with school board representatives from key communities regarding curriculum development and systematic exchange of scientific information for use in this project.
3. Coordinate with other ongoing Alaska ESP education projects. (See the study profile "Conference Management and Reports on MMS Results".)

Methods

1. Identify the key topics and key author(s) of the new manuscript.
2. Produce a chapter outline.
3. Confer with select representatives from Alaskan coastal community school boards and/or educational facilities to collaborate on potential curriculum development. Explore enhancing educational materials as input to mitigation of potential oil industry social impacts, if needed.
4. Produce a draft manuscript.
5. Distribute the manuscript for editing and peer review.
6. Pursue publication and distribution.

Date information is required: The results of the study will be used in NEPA analysis and documentation for lease sales in all Alaska Planning areas, EP's, and DPP's. A final product will be due September 2010.

Revised Date: September 2005

Region: Alaska

Planning Area: Beaufort Sea

Title: Verification of Biological Construction Effects of Northstar Pipeline on the Benthic Community and Temperatures

MMS Information Needs to be Addressed: The potential effects of development construction are a public concern associated with OCS development in the U.S. Further understanding of the pipeline and its various effects are of importance to future MMS Alaska OCS Region EIS's, EP's, and DPP's. This study will generate analyses of utility for EA and EIS documentation, and an empirically-based framework for predicting and managing potential effects.

Period of Performance: FY 2007-2008

Description:

Background The nature and intensity of construction and development effects of buried pipelines are now only hypothetical because Northstar is the first oil development and pipeline in Alaska OCS waters. The Northstar EA predicted minor effects of pipeline trenching limited to habitat loss in pipeline corridor waters deeper than 6 feet (1.8 m). New organisms were expected to be carried by existing currents into the affected area with natural repopulation of the trench by infaunal invertebrates within a few years. However, the actual effects have not been documented. Because benthic invertebrates, especially bi-valves and polychaetes, and epibenthic crustaceans are prey for many vertebrate predators such as fish and birds, effects of disturbance may influence higher trophic levels, including other fish and marine mammals.

Enhanced prediction of effects on higher trophic levels, including fish, birds and marine mammals, depends on the scope of pipeline effect assessments. Documenting full scope of potential effects will lead to more supportable conclusions in future EIS's.

Objectives Test the hypothesis that natural restoration and repopulation of the backfill by infaunal invertebrates occurs within a few years and that resulting communities are similar to those that existed prior to pipeline construction.

Methods The study will require compilation and analysis of existing data, collection of new pertinent information, coordination with similar research conducted in the region, detailed comparative analysis, and development of summary recommendations. Because this is a monitoring study related to Northstar, MMS will consider this to be made part of a task order of cANIMIDA. The methods are:

1. Compile existing data regarding soft-bottom benthic habitat and community composition prior to and after Northstar pipeline construction.

2. Generate a power analysis of the field methods and an analytical summary of pipeline construction effects.
3. For statistical/analytical control purposes, identify similar habitat unaffected by pipeline construction or other development activities. Collect parallel data in those communities at several water depths (e.g. 10, 15 and 20 meters).
4. Identify additional variables that may be essential in evaluation.
5. Analyze the data compiled in (1) and (2) above to develop comparative analysis, e.g. before/after, control/independent (baci) evaluation, of the extent of recovery to soft-bottom benthic habitat and community composition and any effects that may have persisted 3 years after construction.
6. Report findings and general recommendations relevant to future pipeline construction and monitoring.

Date information is required: Study results will be used in future MMS Alaska OCS Region EIS's, EP's and DPP's. The final report will be due December 2008.

Revised Date: September 2005

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDIES PLAN FY 2006

Region: Alaska

Planning Area: Chukchi Sea

Title: Chukchi Offshore Monitoring in Drilling Area (COMIDA)

MMS Information Needs to be Addressed: This study will constitute a key component of Chukchi Sea environmental studies pertinent to Chukchi Sea Lease Sale 193 scheduled for 2007. Industry has expressed strong interest in leasing in this Lease Sale, likely to be followed by exploration and possibly development. Current information on selected topics is available but certain physical information dates to the 1970's.

In order to assure methodological continuity over time and for a potentially large exploration area, appropriate planning and implementation of monitoring baselines are needed. MMS will use information obtained in post-sale and post-exploration decision making and mitigation.

Period of Performance: FY 2006-2011

Description:
Background Both offshore and onshore oil development and production activities are increasing across Alaska's North Slope. Coastal indigenous peoples are particularly concerned about long term effects of potential offshore exploration and development. Lease Sale 193 DEIS and potential EP's and DPP's are expected to lead to recommendations and need for meso-scale monitoring of potential impacts.

Objectives To gather long-term monitoring information which will provide a basis of continuity and consistency in evaluation of potential impacts in the general areas and region of the Chukchi Sea offshore exploration and development.

Methods Priority monitoring issues will be determined through public and interagency comment and coordinated with lessees and other organizations to increase the effectiveness and efficiency of this study. The following methods are subject to change following further public and interagency input:

Phase I: Year 1 Environmental Baselines
1. Perform a brief and focused literature review on non-MMS and MMS-sponsored applicable studies.
2. Hold interdisciplinary planning workshop
3. Initiate baseline efforts in the appropriate physical environmental parameters (e.g., sediment quality and deposition, under-ice currents, underwater noise, etc.).
4. Coordinate the above baseline efforts with any ongoing or previous applicable MMS or industry site-specific monitoring.

Phase II: Years 2-5 Integrated Monitoring

1. Implement detailed interdisciplinary monitoring, as appropriate, as identified through additional public and interagency input.
2. Compile monitoring results into statistical, GIS, and other formats of spatial, temporal, and pattern analysis useful to decision making and operational evaluation.
3. Use field logistics as necessary including limited air support in ice-covered seasons and fixed-wing aircraft and/or vessels in "open" water season to support data gathering.
4. Integrate traditional knowledge sources as appropriate.
5. Inform managers of significant changes.

Date Information Required: Information will be used in NEPA analysis and documentation for Chukchi Lease Sales, EP's and DPP's. Literature review and reports of results of physical environmental monitoring are due in July of the first year of the study. Draft and final annual reports on monitoring are due July in the second, third and fourth years of the study. A comprehensive final report of monitoring results for the entire study is due in July of the fifth year of the study. Field reports, draft reports, and final reports are to be in a format and schedule optimized for use by decision makers and MMS Performance Indicators.

Revised date: September 2005

ENVIRONMENTAL STUDIES PROGRAM: ANNUAL STUDIES PLAN FY 2006

Region: Alaska

Planning Area: Beaufort Sea

Title: Mapping of Ice Gouge and Strudel Scour Density for the Beaufort Sea Utilizing Existing Data

MMS Information Needs to be Addressed: The interim and final information from this study will be used in NEPA analysis and documentation for Beaufort Sea Lease Sales, EP's, and DPP's.

Period of Performance: FY 2007-2010

Description:
Background Quantitative information on ice gouge and strudel scour is sparse to non-existent in the Beaufort Sea. Ice gouge data were last collected on a regional basis over 20 years ago when instrument and navigation quality was less accurate than current technology. MMS has reviewed all of the available ice gouge and strudel scour data for site-specific surveys and development surveys in the Beaufort Sea. We have determined that there are insufficient interpreted data to predict the occurrence, extent and magnitude of these features. In addition, we do not know the relationship between overflood limit and the occurrence of strudel scour over most of the nearshore portions of the Beaufort Sea where offshore oil and gas pipelines may be located in the future. The data sets associated with magnitude of the occurrence of ice gouge and strudel scour are critical in evaluating the degree of risk associated the building of pipelines to offshore fields in the Beaufort Sea.

These data tie into other recently collected site survey and development pipeline surveys compiled in the MMS Sub-sea Physical Environmental Database (SPED) for the Beaufort Sea. This study did not analyze existing MMS geophysical records present for quantitative data on ice gouge or strudel scour. There is a new proposal to collect ice gouge and strudel scour data for the proposed natural gas pipeline in the Beaufort Sea. These data if collected would be incorporated into the current database and analysis effort.

Objectives
1. Estimate the density and degree of severity of ice gouging for all of the site-specific surveys in the Beaufort Sea utilizing the available MMS geophysical seismic records.
2. Map the strudel scours found within the site-specific surveys with MMS geophysical records (few if any).
3. Incorporate the new information into the SPED for the Beaufort Sea, Alaska.
4. Estimate the ice gouge density across the Beaufort Sea Shelf based upon the mapped ice gouges and bathymetry.

5. Estimate the statistical significance between ice gouge intensity, bathymetry and sea ice severity.
6. Update the current Graphical User Interface for the analysis of ice gouge, strudel scour (if observed) as they relate to bathymetry, and the concentration of sea ice.
7. Update the database documentation and data loaders.
8. Describe the methods for the collection and analysis of the data.

Methods

1. Map the density and magnitude of ice gouges for the Beaufort Sea using the available MMS geophysical seismic records and data.
2. Incorporate data into the current SPED.
3. Provide new tools within to query the newly established data.
4. Compare the occurrence of ice gouge to water depth and to the magnitude of sea ice using statistical methods.
5. Describe the methodology to analyze the data.
6. Provide final database, database documentation and database design based upon Coastal Offshore Resource Information System (CORIS) standards.

Date information is required: The interim and final information from this study will be used in NEPA analysis and documentation for Beaufort Sea Lease Sales, EP's, and DPP's. An interim report will be due December 2008. A draft and final report will be due October and December 2010, respectively.

Revised Date: September 2005

SECTION 3.0 TOPICAL AREAS FOR FY 2008

This section presents a general forecast of significant topical issues and concerns to be addressed by proposed studies for FY 2008 and beyond. In general, these topics conform with the research themes of the NSP. Due to the great differences existing between Alaska environments and other OCS areas, the uniqueness of issues in Alaska has dictated the need to anticipate new topical areas for needed implementation within the Alaska ESP. These projects will focus on MMS mission needs within the context of increasing industrial development and potential trends in changing climates. Specific geographic emphases are likely to change due to potential changes in leasing or development schedules.

Many of the studies proposed for FY 2006 and FY 2007 address the topical areas described below. These will be re-assessed as part of the FY 2007 planning process.

Offshore production started at Northstar in 2001. Industry proposes exploration in the Beaufort Sea and may propose development projects. As of September 2005, MMS proposes lease sales in the Alaska OCS in the *Final Outer Continental Shelf Oil and Gas Leasing Program 2002-2007*: one in the Beaufort Sea; one in Chukchi/Hope Basin; one in Cook Inlet/Shelikof Strait; and possibly one in Norton Basin. For these reasons, it will be important to continue monitoring studies and other priority studies of key species and marine communities. Monitoring of bowhead whales will continue, and additional studies may be brought online which address ringed seals, kelp communities, fishes and migratory waterfowl. Studies will vary from description of behaviors and habitat to monitoring for changes. Additional studies of the physical environment such as current regimes and ice characteristics will be proposed to support interpretation of data from living resource investigations and to provide a better understanding of the fate and dispersion of OCS discharges.

3.1 Physical Oceanography

One of the emerging issues in the Alaska OCS Region, is the need for better, finer scale circulation and oil spill models and higher resolution data for the nearshore portions of the Beaufort Sea. Multiple offshore oil fields have been developed (Endicott and Northstar), exploration efforts may accelerate, and development plans potentially can be submitted. MMS will be completing a nearshore Beaufort Sea ice-ocean circulation model. One goal is further development of this model into a nowcast/forecast ice-ocean-oil spill system for the nearshore Beaufort Sea.

Construction of such a system requires formation of a user group, higher data density, and ability to assimilate such data into the model in real-time. The Region will be working toward forming a users group to provide surface radar mapping capabilities and data for the nearshore Beaufort Sea and other Alaskan waters as needed. Over the past 25 years, oceanographic radar techniques have been developed and improved to the point that detailed, grided, 2-dimensional maps of surface circulation can be provided and recorded in real time and directly assimilated into real-time models.

Additional improvements will also be needed in sea-ice aspects of the modeling. The resolution of ice models and ice data needs to be increased to address the fine scale interactions necessary to model oil spill trajectories in the nearshore Beaufort Sea and Chukchi Sea, including within and among the barrier islands. Ice models currently in use by MMS and others use relatively simple thermodynamics and ice thickness distribution, approximating the ice as slabs of a one to few thicknesses plus open water. While sufficient as a first approximation of the arctic ice pack, this treatment lacks the ability to sufficiently resolve the spectrum of ice thickness from thin new ice to thick-ridged ice to landfast ice. In addition, these ice models are based on empirical ice physics valid at a 100-km scale and extrapolated to smaller grid dimension. The MMS will work to improve the state of the art in ocean-ice modeling and to produce either a stand-alone model or one that can be coupled to and or nested in existing ice/ocean models.

3.2 Fate and Effects

The Region has collected baseline biological and chemical monitoring data in the vicinity of the Liberty Prospect and Northstar as part of the study *Arctic Nearshore Impact Monitoring in the Development Area* (ANIMIDA). The summer of 2002 was the last full field season for ANIMIDA. With Northstar in production and the potential for other developments being proposed, there will need to be a follow-on monitoring effort to quantify construction and develop effects. The Region has initiated a continuation of cANIMIDA for FY 2003-2008. The frequency of sampling will probably be less than in the original years of the ANIMDA project. BPXA put its plan for developing the Liberty Prospect on hold in January 2002; as of September 2005 it is pursuing options for development and production. Liberty was the first oil development proposed for OCS waters in Alaska. However, collecting information at this site is useful for the long term monitoring continuity. Developments are possible at this site or others in the central Beaufort.

In addition to site-specific monitoring, there is a need to re-examine the regional pollutant levels in the U.S. Beaufort Sea. The MMS set up the Beaufort Sea Monitoring Project (BSMP) in the 1980's to monitor sediment quality. The BSMP monitors trace metal and hydrocarbon levels in sediments and benthic biota at specific locations on a regional basis. The ANIMIDA project has resampled BSMP stations locally near Northstar and Liberty, but not elsewhere. Regional BSMP sampling has not been done since 1989 and needs to be repeated.

The international Arctic Marine Assessment Program (AMAP) has recommended that additional chemical compounds be included in Arctic monitoring studies because of their increasing levels. Because of AMAP recommendations and other issues, mercury and persistent organic pollutants are likely to be added to the BSMP analyte list.

3.3 Sea Bed and Sub-sea Bed Physical Processes

MMS has reviewed all of the available ice gouge and strudel scour data for site-specific surveys and development surveys in the Beaufort Sea. We have established that there are insufficient interpreted data to predict the occurrence, extent and magnitude of these features. In addition, we do not know the relationship between overflood limit and the occurrence of strudel scour over most of the nearshore portions of the Beaufort Sea where offshore oil and gas pipelines may be located in the future. The data sets associated with magnitude of the occurrence of ice gouge and strudel scour are critical in evaluating the degree of risk associated the building of pipeline to offshore fields in the Beaufort Sea. These data would tie into other recently collected site survey and development pipeline surveys compiled in the MMS Sub-sea Physical Environmental Database (SPED) for the Beaufort Sea.

3.4 Endangered and Protected Species

Production at the Northstar site and OCS activities possible at other sites may lead to risks of oil spills from buried pipelines, other discharges, noise from various industrial and support activities and increased human interaction with arctic offshore species. Species protected under the Endangered Species Act (ESA), Marine Mammal Protection Act, and Migratory Bird Treaty Act are of particular concern if impacted by such factors. Study of the effects on protected marine mammals, and the need for continued monitoring of endangered species are expected to be continued – as well as assessment of how any changes in the bowhead whale migration's distance from shore could relate to subsistence success (see below). Future bowhead studies are expected to continue to explore use of satellite tagging for information on bowhead whale residence times in development areas and information on bowhead behavior in response to industrial noise. Also needed, will be continuation of vital region-wide fall monitoring of the migration by the MMS Bowhead Whale Aerial Survey Project (BWASP) and additional knowledge it obtains on bowhead feeding patterns.

Effects of construction activities on polar bears, especially on denning bears and concerns about the adequacy of information about all age/sex categories of the bear population will need to be addressed by additional research. Several ongoing studies are expected to lead to recommendations for additional information regarding polar bears and continued study of the bear population's vulnerability to oil spills through improved models.

Other key subsistence species potentially exposed to short-term or cumulative impact factors include beluga whales, ringed seals, and bearded seals for which behavioral or monitoring studies may be needed.

3.5 Waterfowl in Lower Cook Inlet

Information on waterfowl abundance and species composition in predominant bays of Lower Cook Inlet is needed. A study by the U.S. Geological Survey identified the Upper Cook Inlet as an extremely important migration and wintering area for shorebirds. Major

portions of the Western Sandpiper, Dunlin, and Rock Sandpiper populations either migrate through or winter in Cook Inlet, and at least four major bays in the Upper Cook Inlet qualify as Western Hemispheric Shorebird Reserve Network sites. Assessing the relative importance of bays in the Lower Cook Inlet will complement the previous study and improve evaluation of potential impacts of oil and gas exploration, development and production.

Steller's eiders, common eiders, surf scoters, white-winged scoters, black scoters, long-tailed ducks, and harlequin ducks all winter, stage, or molt in lower Cook Inlet marine habitats. Steller's eiders are listed as a threatened species and population estimates for long-tailed ducks, scoters, and common eiders are also indicating long-term declines. Causes of these declines are unknown. Winter and spring survey data in lower Cook Inlet are incomplete and sporadic. Distribution and abundance information is needed to better evaluate risk to populations or habitats from oil and gas activities, to better evaluate species status population trends, and to further understand causes of declines. MMS can also use such information for oil spill contingency planning, establishing baseline information for long-term monitoring and mitigation planning, and establishing survey protocols for long-term monitoring.

3.6 Effects on Unique Marine Benthic Communities

Pipeline construction and other activities may generate sediment plumes that could potentially impact the unique "Boulder Patch" benthic community, known to cover an extensive area to the northwest of the Liberty site in Stefansson Sound. This is a boulder-strewn seabed area with a kelp-dominated community. Similar areas are known to exist to the east in Camden Bay. Some kelp plants in the Boulder Patch are up to 40 years old. One of the ongoing studies in the cANIMIDA project focuses on kelp productivity and will use inherent optical properties of ice and water to estimate the potential effect of sediment resuspention on kelp productivity. Optical-related measurements will include spectral irradiance, light scattering coefficients, and total suspended solids. Results of this work will be used to formulate future information needs related to this issue. Research on invertebrate and vertebrate components of this community and refined development of monitoring protocols are anticipated for the future.

3.7 Marine Fish Migrations, Recruitment and Essential Fish Habitat

Nuiqsut villagers are concerned that OCS activities have affected arctic cisco populations in the Colville River and reduced subsistence utilization. Until consistent time-series data regarding wind-driven recruitment of young-of-year arctic cisco and recruitment of that population are available, offshore oil and gas development might be considered a potential impact-causing factor. Thus, additional research on near-shore arctic fisheries and recruitment to Colville River populations should be considered.

Proposed and recent pipeline construction in the Beaufort nearshore have led to concerns about effects of trenching and back-filling on fish populations and habitats. Several important fish species used for subsistence migrate through or are found in the Northstar

and Liberty areas, including arctic and least cisco, Dolley Varden char, and humpback and broad whitefish. Also, intermittent occurrences of pink and chum salmon may be found in Beaufort coastal waters. As a result of the Magnuson Fishery Conservation and Management Act, Beaufort waters are considered as Essential Fish Habitat (EFH) for endemic salmonids. Future research on salmonid reproduction in drainages to the Beaufort Sea may be necessary in order to clarify environmental assessment and mitigation needs.

3.8 Biotechnology Potential

In the future, the search for oil and gas on the OCS may be joined by the search for genetic and biochemical resources found in marine organisms. Such resource could one day lead to new therapeutic drugs for fighting cancer, AIDS or heart disease. Many DOI bureaus are considering the possibility of locating, conserving, and licensing the natural products of their trust resources.

The MMS has had a long history of studying the ecology of platforms and currently the MMS Gulf of Mexico and Pacific Regions are conducting studies to examine the availability and distribution of bioharvestable marine organisms on OCS structures. Thus far, several "candidate" organisms producing possible therapeutic natural products have been identified. One candidate organism, the bryozoan, *Bugula neritina*, lives in the Gulf and potentially could be commercially harvested from OCS platforms. This organism produces a chemical, Bryostatin 1, which is in Phase II trial testing as a treatment against non-Hodgkin's lymphoma and chronic leukemia. If OCS platforms can be shown to be a ready source for this organism, then MMS may be dealing with this emerging issue in a significant way. As these MMS Gulf and Pacific Regional studies progress, the Alaska OCS Region may consider whether similar research efforts should be initiated.

3.9 Subsistence

Residents of the North Slope coastal communities frequently express concern about cumulative impacts of offshore and onshore developments on their subsistence lifestyle. The villages of most concern are Kaktovik, Nuiqsut, and Barrow. Consideration of cumulative impacts is an increasingly important issue for MMS in preparing NEPA documents. Some of the concerns of the Inupiat are access to hunting and fishing areas being limited by oil industry infrastructure, reduced harvests, increased hunter efforts, and increased hunter cost. How and to what degree subsistence activities have been affected over the last 10 years or so by industry infrastructure and industry activity is a concern that may be addressed by research.

Related to the long-term study of the cumulative effects of oil industry on subsistence is a broader set of issues of how the Inupiat society has been potentially affected. Aspects such as how the cash component of households affects involvement in subsistence activities, stress, sharing of subsistence resources and involvement of younger Native in subsistence compared to their elders. Social indicators should be studied to serve as a basis for estimating long-term cumulative impacts.

3.10 Natural Gas Pipeline

One of the routes for the natural gas pipeline being considered by industry is from Prudhoe Bay, northward to about 4 miles offshore, eastward 300 miles, then southward along the Mackenzie River, and finishing at Calgary, Alberta. Most of the offshore portion would be on the US OCS. (The other major alternative is onshore.) If the preferred route is on the OCS, MMS would be responsible for issuing permits. A buried gas pipeline (as opposed to an oil pipeline) under the seafloor of the Beaufort Sea is a new issue. If the Beaufort OCS is the preferred route, the Alaska Region may need to conduct environmental studies on a variety of environmental issues.

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Appendix: Potential Study Type

Key to abbreviations (for others not listed here see table of contents, acronyms):
C: Contract
CA: Cooperative Agreement
IA: Interagency Agreement
JF: Joint Funding
TO: Task Order
USGS BRD: U.S. Geological Survey Biological Resources Division

Title	Type
STUDIES PROPOSED FOR FY 2006	
Feasibility and Study Design for Boundary Oceanography of the Beaufort Sea	JF/IA
Beaufort Sea Marine Fish Monitoring	C or JF
Beaufort Sea Mesoscale Meteorology	JF/IA
Mapping Sea Ice Overflood Using Remote Sensing from Smith Bay to Camden Bay	C or JF
Ecological and Oil Spill Implications of Colville and Mackenzie River Plumes	C or JF
High-Resolution Regional Bathymetry for Beaufort Sea Continental Shelf	C or JF
Arctic Cisco Genetics and Otolith Microchemistry	C or JF
Invasive Species Workshop	JF/IA
STUDIES PROPOSED FOR FY 2007	
Worst-Case Blowout Occurrence Estimators for the Alaska OCS	C
Arctic Cod Distribution, Habitats and Influence on Beaufort Ecology	C or JF
Arctic Fish Ecology Catalogue	JF/IA
Development of a Long-duration Implantable GPS Transmitter for Sea Ducks	C
Joint Funding Opportunities in Existing Marine Bird or Marine Mammal Studies	JF
Socioeconomic Book-Phase II	C, JF or in-house
Verification of Biological Construction Effects of Northstar Pipeline on the Benthic Community and Temperatures	C or JF
Chukchi Offshore Monitoring in Drilling Area (COMIDA)	C/TO
Mapping of Ice Gouge and Strudel Scour Density for the Beaufort Sea Utilizing Existing Data	C

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